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FARMING IN THE AUCKLAND PROVINCE.

OBSERVATIONS ON FARM-MANAGEMENT METHODS.

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III. THE MIDDLE WAIKATO BASIN.

HOCHSTETTER(9) travelled up the Waikato River in 1858, and, on reaching Taupiri, climbed to the top of the Taupiri Mountain, and, looking over the Middle Waikato Basin, described the area as follows :—

> Here I beheld for the first time an extensive lowland spreading into distant mountain cones and remote mountain chains. . . . Like mirrors resplendent with the broken rays of the sun, you see glistening numerous lakes, and the serpentine currents of large rivers winding through the plains. The Waikato is the main river in this richly watered, fertile basin, which in its extent from the western to the eastern mountain ranges I call the Middle Waikato Basin. The Waikato flows through this basin in the direction of south-east to north-west, a distance of thirty-five miles. Immediately at the foot of the Taupiri the Mangawara joins it, running through large swamps in the east, and five miles further up it receives the Waipa, a principal tributary from the south-west. Up the Waipa towards the south-west and south, along the western coastal range, the lowland extends as far as the slopes of the picturesque trachytic mountain Pirongia, and the spurs of the Rangitoto Range, where from the midst of the plain Kakepuku rises with regular conical slope. To the south and south-west, where the Waikato enters from the southern tableland into the basin, there rises majestically the trachytic Maungatautari. Thence springs up a low range of hills, the Maungakawa range, separating the eastern portion of the basin—the plains of the Piako and Waihou, rivers of considerable size emptying into the Hauraki Gulf—from the Waikato and Waipa Plains. But it is only the steep margin of the eastern coast range, from the Patetere Plateau to the Aroha Mountain, that forms the eastern boundary of the basin. This whole basin was, previous to the last elevation of the North Island, which was probably connected with the volcanic eruptions in the centre of the Island, a bay of the sea, extending from the Hauraki Gulf far into the interior. The steep margin of the surrounding ranges has continued to this day, displaying the seashore of old, and the singular terrace formations on the declivities of the hills and river-banks within this basin is the result of slow and periodical upheaving.

THE WAIKATO AND WAIPA PLAINS.

The plains of the Waikato and Waipa Rivers consist of low rolling hills, flat areas of alluvial land, and large peat swamps. The soils of the low rolling hills are loams and clay loams (derived from volcanic ash-showers) of fair natural fertility, and it was on these low rolling hills that settlement first took place. The soils of the wide plains of the Waikato are sands and loams derived from pumice sand deposited by the Waikato River. The peat areas are generally of low natural fertility, and are still largely unoccupied.

Church of England missionaries introduced farming to the Waikato Natives about 1840. The Rev. John Morgan (Te Awamutu) introduced English methods of farming, brought in English fruit-trees, taught the Natives to grow wheat and to grind it in their own water mills. The period from about 1845 to 1860 was an era of peaceful progress and industry amongst the Waikato Tribes. The farming missionary succeeded in giving the district round Te Awamutu a thoroughly settled and Home-like appearance. The wheat grown by the Natives in the Rangiaowhia – Te Awamutu district was ground at the mills, bagged, and sent down to the European settlements for sale. The flour was carted in bullock-drays to Te Rore, where it was loaded into canoes. The canoes were paddled down the Waipa and Waikato Rivers along the Awaroa to Waiuku and there loaded into cutters and transported to Onehunga. It was finally taken across the isthmus to Auckland—a total journey of over a hundred miles from the flour-mills of Rangiaowhia. The Maoris invested the proceeds in clothes, blankets, tea, sugar, and all kinds of European goods, and then began their homeward journey(10).

A variety of elements, social and political, combined to produce a war feeling in the Waikato. The Waikato Tribes had always been averse to selling their land to Europeans, and aspired to form a separate Maori State in the centre of the North Island. The Waikato War was precipitated by trouble arising out of disputed land-purchases in Taranaki. In 1864 there was severe fighting in the Waikato, and the Maoris were finally defeated at the Battle of Orakau. The Government confiscated the land of the rebellious Natives under the New Zealand Settlement Act of 1863 and settled the country with disbanded militiamen and civilians—about 3,000 military settlers, each of whom received a grant of one town acre and a farm section of from 50 acres upwards, according to rank.

The new settlers adopted mixed-farming methods—wheat and potatoes were the marketable crops, cattle and sheep were fattened, and butter was made on the farms and traded to local storekeepers. The depression in the "eighties" was severely felt in the Waikato, and it was not until the late "nineties," when the dairy industry was becoming established, that farmers were at all prosperous. Small cheese-factories had been started in the early "eighties," but, owing to poor road communication, the factories could not draw sufficient regular supplies of milk, and had to go out of business. The dairy industry was successfully launched in the "nineties" by the inauguration of a system of skimming-stations or creameries to which the farmers brought their whole milk, and the cream separated at these skimming-stations was manufactured into butter at a central factory. With the development of an export trade, further changes were introduced—establishment of co-operative factories, the practice of home separation, and improved road transport. Dairying, which had developed as a sideline to mixed farming, became a separate enterprise. Permanent grassland took the place of short-rotation pastures, and the practice of intensive grassland farming was slowly evolved. To-day grass-farming in the Waikato has reached a very high standard of efficiency.

The Waikato enjoys a warm humid climate; the annual rainfall is about 50 in., and is well distributed. Farming is grass-farming—dairying and the production of lamb, mutton, wool, and beef from

permanent grass. It was in the Waikato that the practice of top-dressing started. Prior to the advent of top-dressing, pastures soon deteriorated, and after being down from four to five years they were ploughed up, the land cropped with cereals and fodder crops, and then

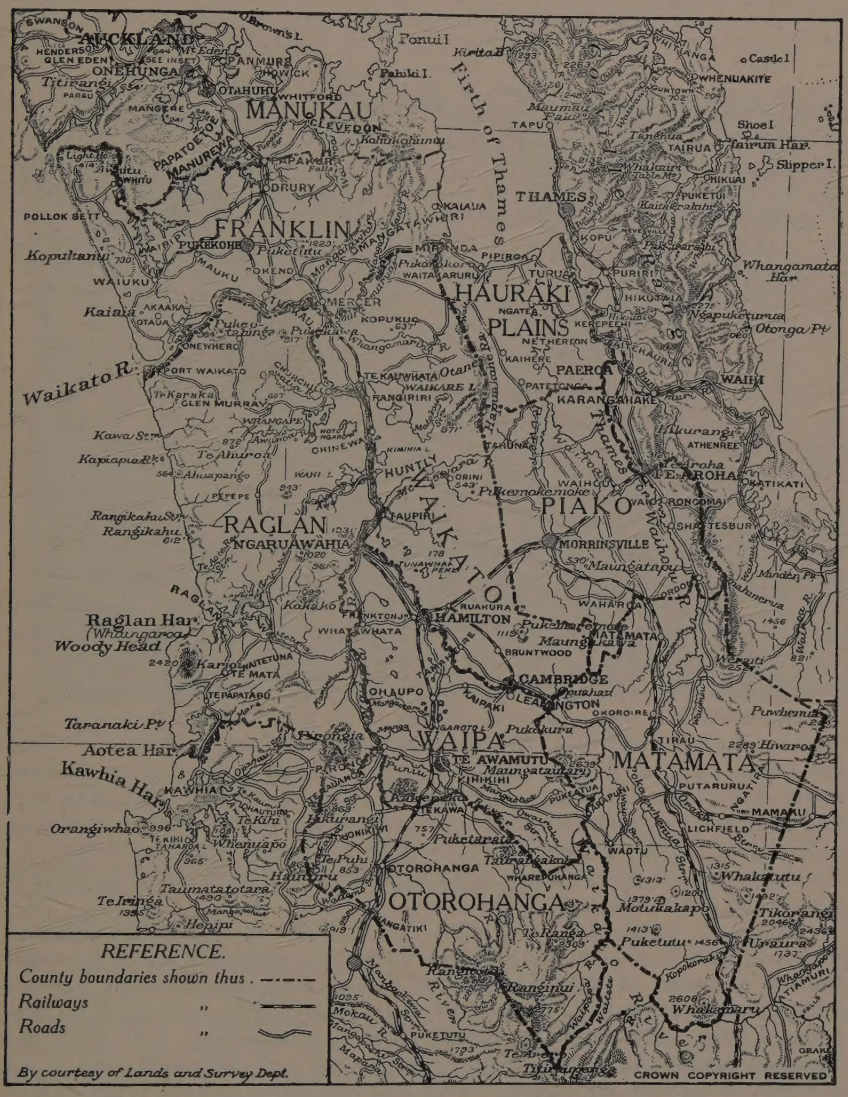

FIG. 4. SOUTH AUCKLAND, LOWER AND MIDDLE WAIKATO BASINS.
Journey in southern Waikato, Waipa, and Otorohanga Counties.

sown down to grass again. The first attempts at pasture improvement by top-dressing were probably made in the early "eighties" on old grassland near Cambridge. By 1900 top-dressing with phosphatic

fertilizers was becoming a recognized practice, and at the present time most of the grassland is top-dressed annually.

*Table III.—Crops and Live-stock: Table showing Areas in Crops and Pasture and Numbers of Live-stock in Waikato Counties, 1933–34.**

County.	Crops.			Live-stock.			
	Annual Crops.	Pasture.	Pasture cut for Hay and Silage.	Dairy Cows.	Other Cattle.	Sheep shorn.	Pigs.
	Acres.	Acres.	Acres.				
Waikato† ..	5,293	203,712	22,716	73,020	43,856	94,666	27,901
Waipa ..	4,036	176,015	25,085	72,329	41,715	96,489	28,370
Otorohanga† ..	4,581	122,339	11,745	34,635	25,381	62,602	15,147
	13,910	502,066	59,546	179,984	110,952	253,757	71,418

* From Agricultural and Pastoral Statistics. † Only parts of Waikato and Otorohanga Counties are on the Waikato and Waipa Plains.

Dairying and fat-lamb raising are the chief farming industries. Swedes and soft turnips are grown and hay and silage saved for the winter and summer supplementary feeding of dairy stock. Where the soil is suitable, lucerne is becoming a crop of some importance, and Waipa County has 1,015 acres of lucerne. Grass-farming has reached a high standard of efficiency—the production of 150 to 200 lb. of butter-fat per acre and a carrying-capacity of four ewes to the acre are not uncommon. Romney ewes for fat-lamb raising and store cattle for fattening are drawn from a wide area—from the East Coast, King-country, and Wellington Districts; four- and five-year-old Romney ewes are mated with Southdown rams, and usually 90 per cent. of the lambs are got away fat off their mothers.

January 21st, 1935: Motumaoho, Tauhei, Orini, Newstead, Hamilton.—An intensely hot day, pastures all burnt up after a long period of dry weather, and the air thick with the smoke of peat fires. Here and there are green patches in the pastures, which indicate areas of paspalum. Even this plant is feeling the effect of the exceptionally dry weather, and is throwing much less feed than it does in normal years. Lucerne also shows a poor growth, and there is no doubt that the only real insurance for the dairy-farmer against prolonged drought is an adequate reserve of grass silage.

Paspalum could be used more extensively in Waikato pastures; where control is good in the summer there is no difficulty at all in maintaining a sward of rye-grass, white clover, and paspalum—a pasture which has probably the highest carrying-capacity that is possible on this class of land. Paspalum is usually slow in establishing, and, with the common method of sowing from 3 lb. to 5 lb. of paspalum-seed in an ordinary rye-grass, cocksfoot, clover mixture, it is several years before much paspalum is seen. Paspalum needs really warm conditions for quick germination, and a practice has begun of establishing paspalum alone or with a cover crop (such as soft turnips or Japanese millet) in late November or December. Sown alone at the rate of 10 lb. per acre in December, paspalum establishes very rapidly. I recently saw a 5 acre field which was sown this way last December and which is now almost completely covered with paspalum plants. For sowing in this

way the land should be worked up to a good clean seed-bed as for ordinary grass-sowing, rolled, and from 8 lb. to 10 lb. of paspalum-seed sown along with 1 cwt. of superphosphate. In the autumn the field should be harrowed and rye-grass and white clover broadcasted. Only a light surface cultivation is required to secure a seed-bed for the autumn-sown rye-grass and white clover. Any one who wishes to secure a dominant paspalum pasture quickly is advised to try this method of establishment.

[*Photo by H. Drake.*

FIG. 5. RUAKURA FARM OF INSTRUCTION, WAIKATO COUNTY.

The Ruakura Farm Training College offers a course in farm-training to lads of not less than sixteen years of age; the course for the full curriculum occupies eighteen months, but the ordinary course is completed in one year. Instruction is imparted by lectures and by field classes and demonstrations. The year is divided into two terms of twenty-four weeks. The fee for each term for tuition and board is £18. Application for admission should be made to the Director of the Fields Division, Department of Agriculture, Wellington.

There are in evidence numerous crops of Japanese millet which are doing well in spite of the dry weather. Japanese millet is a crop that does well in a hot season, and has been well worth while sowing in a year like this. Eight or ten years ago crops of Japanese millet used to be quite common, but they went out as the practice of making grass silage became common.

Peat fires were burning strongly in the Motumaoho, Orini, and Newstead districts. These Waikato peat lands are a great problem—originally great swamps covered in rushes and stagnant water, the areas have now been drained or partially drained, with the resulting change in natural vegetation from rushes and moss to manuka and bracken fern. Undrained peat is extremely wet, whilst overdrained peat is extremely dry—once thoroughly dried it does not readily rewet, but forms a light porous mass that is nearly always fluffy and dry; in fact,

water may lie in puddles on peat land from the bottom of which perfectly dry peat can be scooped up. The essentials in grassing peat land are gradual drainage and consolidation. The initial grassing of raw peat swamps is done with Yorkshire fog and *Lotus major*—two plants that are admirably suited for pioneer grassing-work on raw and unconsolidated peat: paspalum, also, could be made more use of than it is. It is only where really careful drainage, consolidation, and management have been practised that reasonable pastures with a fair proportion of rye-grass and white clover in them can be established. When overdrained, the surface dries out badly in the summer and the main pasture constituents are Yorkshire fog and brown-top.

It will probably be next season before the peat areas which are at present burning can be regrassed, for the peat fires are not likely to go out until the water in the swamps reaches its winter level. These uncontrollable summer fires do a great deal of harm—the peat being dry to a considerable depth the fires burn deeply, leaving an uneven surface with often great holes. Surface burning is a great help in getting a good strike of grass and clovers, but it must be controlled burning; generally, if the peat is sufficiently consolidated, the area is ploughed, the furrow slices allowed to dry out, and burnt whilst the bottom is still wet. This type of burning gives a thin ash layer in which to sow grass and clover seed. There is still a good deal of difference of opinion whether peat should be burnt or not; certainly burning gives the best seed-bed and the best establishment of grass and clover. Arthur Young's remarks on the subject are of interest: in his Farmer's Calendar, he writes:—

> By one set it (paring and burning) is pronounced contrary to every principle, that it is a wasteful, extravagant operation, which dissipates what should be retained; annihilates oils and mucilage; calcines salts, and reduces fertile organic matter into ashes of a very weak efficacy: that the vegetable particles which are brought into play at once, for the production of a single crop, by less desperate management might be husbanded to the support of many. On the contrary, the advocates for this management assert that these objections are all founded on vain reasoning and philosophical theory: that the practice the most decided and experience the most extended pronounce it to be an admirable system: and that the mischiefs often quoted as flowing from it are to be attributed merely to the abuse of the method, and by no means necessarily connected with it . . . In the fens of Cambridgeshire upon a peat soil, free from large roots and stones, the work of paring is always done with a plough, which they make on purpose for the work, and which executes it in the completest manner that can be imagined. It turns off a furrow from 12 in. to 16 in. broad and not more than an inch deep.

Local burning, when done, is generally deeper than this; in the first burning of a swamp with a fire just running over the surface it may only burn a couple of inches, but if ploughed (and a swamp plough is sometimes used) six inches to a foot of peat may be burnt off as a preparation for grass.

January 24th, 1935: Ruakura Farm of Instruction.—The Ruakura Farm of Instruction is a farm training college for youths, a stud-stock farm, and a centre for experimental work. The farm has an area of 900 acres, and the general level of the land is broken in parts by low undulations; the soils of the low hills are clay loams, of the flats silts and sandy loams, formed from water-borne pumice, and peat; the peat areas occupy a considerable area of the farm and are of quite low fertility. In common with other Waikato farms, the bulk of the land is under permanent grass, and dairying, fat-lamb raising, and the production of stud stock are the chief farming industries. The farm maintains

pedigree herds of Jerseys, Ayrshires, Milking Shorthorns, and Guernseys : about 150 cows are milked in two sheds. The annual draft of pedigree bulls is disposed of as yearlings and heifers as two-year-olds. There is a registered flock of 200 Southdown sheep, together with 1,500 to 2,000 cross-bred ewes, from which fat lambs are raised. Pedigree herds of Berkshire, Large White, and Tamworth pigs are kept, and I was present at the weighing of various lots of fattening pigs. Recently the outdoor grazing of pigs has received considerable attention from Waikato farmers, but there is a great deal yet to be learnt regarding the value of grass for fattening pigs. Young grass can form a very important part of the ration of dry sows and store pigs, but its exact value for fattening pigs, receiving a diet of skim-milk, requires further investigation. The accepted feed-position in pig-fattening is that 400 lb. of grain or 400 gallons of milk are required to give 100 lb. live-weight gain : a pound of grain and a gallon of milk are of about equal feeding-value : green feed may at times replace concentrates to a limited extent—6 lb. to 8 lb. of green feed are equal to 1 lb. of grain, but green feed can replace only 1 lb. or 2 lb. of concentrates in the fattening pig's ration. The problem is to find just what use, if any, green feed is for fattening pigs getting a skim-milk ration, and, if it is useful, the best method of supplying it. Small ⅛ acre fields require very careful management if a good sward of grass is to be kept on them ; with tramping, and excessive grazing and manuring, the white clover goes out, rye-grass becomes tufted, and the fields are apt to run to bare ground : the grazing and management adopted in ordinary dairying pastures gives the ideal sward for pig-grazing, but it is possible that if pigs are grazed in large fields they may " walk off " too much condition, and, for finishing, sty-feeding is quite likely to come back.

April 15th, 1935 : Hamilton, Matangi, Cambridge.—The Hamilton-Cambridge district is an area of quite intensively managed grassland, the farms are well planted with hedges, plantations, and ornamental trees, which give a very finished appearance to the countryside. Stopped at a Matangi farm and examined an autumn-sown field of Italian rye-grass, sown to provide young grass for early-calving cows. The provision of protein-rich feed for the spring feeding of milking herds still remains somewhat of a problem on the general run of dairy-farms—feed can be supplied by green cereals, temporary pastures of Italian rye, and by nitrogenous manuring of perennial rye-grass pastures, all of which entail expense. The usual method is to shut up phosphated fields in May and June and hold the grass-growth for cows calving in July ; this method is fairly satisfactory provided the fields are well sheltered, but there is often a gap in feeding between mid-August and mid-September—between when the shut-up grass has all been used and when spring growth starts. When this happens herds have to draw on bodily reserves—herds calving in good condition may maintain production at the expense of condition, but with herds calving in poor condition a fall in milk-production is inevitable. A good vigorous strain of Italian rye sown in March produces good autumn, winter, and early-spring feed, and where the farmer can find the time and money for sowing special crops, Italian rye pastures are excellent for spring feeding.

WAIPA COUNTY.

April 17th, 1935 : Hamilton, Te Rapa, Te Kowhai, Koromatua, Ngahinepouri, Ohaupo, Rukuhia.—A fine autumn day ; this is a fairly

slack time on farms, top-dressing is just being completed and feeding out has not started. Feed is fairly short and there has been a fair amount of pasture deterioration on the lighter soils owing to the excessively dry summer weather. Under very hot, dry conditions, white clover dies out and leaves bare ground: this is a very unusual occurrence in the Waikato, but commonly occurs on shingly and sandy soils with a poor capacity for holding water in the summer. In dry climates, or on summer-dry soils in humid climates, subterranean clover often has to be used instead of white clover for grassing dry soils. Subterranean clover is an annual and buries its seed in the ground; the seed germinates in February–March, the young plants have a good autumn, winter, and early-spring growth; growth is luxuriant and very rapid in October and November, whilst the plants start to wither and die about the middle of December. Under the humid conditions and good moisture-holding capacity of Waikato soils, white clover will always be the chief pasture clover of the district, but on summer-dry soils subterranean clover finds a place: it is fairly common on the basic volcanic soils of North and South Auckland.

Waipa County occupies the roughly triangular land area between the Waipa River on the west, the Waikato River on the north and east, and the Puniu River on the south: the south-east corner is on volcanic land surrounding Mount Maungatautari. The land of the county consists of low rolling hills, flat areas of alluvial land—being the flood-plains of the Waikato and Waipa Rivers,—and large peat swamps. The low hills consist of the dissected flood-plain of an old river, and these hills have been covered by volcanic ash-showers; in the north the soils are clay loams—soils that grow good cereals and root crops and good pastures too, but are apt to dry out in the summer; in the south these hills have been covered in more recent ash-showers, the soils are lighter, and have a good summer moisture-holding capacity. The alluvial soils consist of sands—on the banks of the Waikato—sandy loams, silts, and clays. With the exception of the peats, variation in fertility is mainly a matter of moisture-holding capacity: all soils (except poor peat areas) grow good rye-grass, cocksfoot, white-clover pastures if suitably top-dressed and managed.

The progressive improvement during the past thirty years in the carrying-capacity of the grassland has been truly remarkable, and for the 1933–34 season the carrying-capacity was roughly two and a half times as great as in 1906–7. The details of the acreage under pasture, fodder crops, and the number of live-stock for these seasons are given in Table IV.

*Table IV.—Table showing Areas in Sown Grass, Fodder Crops, and Numbers of Live-stock in Waipa County for the Seasons 1906–7, 1926–27, and 1933–34.**

Season.	Crops.		Live-stock.		
	Pasture.	Fodder Crops.	Dairy Cows.	Other Cattle.	Sheep shorn.
	Acres.	Acres.			
1906–7	87,330	9,778	10,321	283,91	223,86
1926–27	165,342	7,672	44,388	338,28	489,12
1933–34	176,015	4,952†	72,329	417,15	964,89

* From Agricultural and Pastoral Statistics. † Includes 1,015 acres of lucerne.

Dairying and fat-lamb raising are the main farming industries, and for the 1926–27 season, when surveys(11) of the farms of the county were made, there were 1,483 holdings (in 1933–34 there were 1,533 holdings), divided as follows:—

Enterprises.	Number of Holdings.
Dairy-farms over 30 acres	863
Fat-lamb farms	58
Dairying and fat lambs	48
Cattle farms	59
Miscellaneous (mainly holdings of less than 30 acres)	455
	1,483

The 863 dairy-farms covered a total occupied area of 164,662 acres, of which 114,146 acres were in pasture and 5,954 acres in annual crops. Classified on the cultivated area, there were 358 farms between 30 acres and 99 acres in area, 345 farms 100 acres to 199 acres in area, and 160 farms over 200 acres. The most important size-groups were farms of 50 acres to 59 acres, 100 acres to 109 acres, 150 acres to 159 acres, 200 acres to 209 acres, and farms over 300 acres. The following table shows the mean area under grass and annual crops, the mean area of grassland top-dressed and hayed, and the mean number of cows milked per 100 acres of cultivated land for groups of dairy-farms for the 1926–27 season(12).

Table V.

Size of Farms.	Number of Farms.	Area in Grass.	Area in Crops.	Area hayed.	Area top-dressed.	Number of Milking Cows, 31st January, 1927.
50– 59 ..	89	95	5	16	78	43
100–109 ..	108	95	5	13	76	37
120–129 ..	34	95	5	13	73	35
150–159 ..	41	94½	5½	12	65	35
200–209 ..	29	95½	4½	12	79	35

The carrying-capacity of these farms in 1926–27 was not particularly high, but there has been a farming revolution since then: from 1928 onwards greater attention has been paid to pasture-management, ensilage has come in, and with more stock there has been more manure, and hence more grass to carry still more stock. This is well shown in Table IV, comparing the 1926–27 carrying-capacity with the 1933–34 carrying-capacity. The area under pasture and crops has increased by 5 per cent., the dairy cows by 63 per cent., other cattle by 23 per cent., and sheep shorn by 97 per cent.

In the 1926–27 survey(13) there were 58 holdings devoted to fat-lamb raising, occupying a total area of 27,941 acres, of which 18,969 acres were in grass and 1,150 acres in annual crops. The average (mode) size of holding classified on the improved area was between 300 acres and 400 acres, and the mean carrying-capacity was about 2 ewes to the acre (it will now be about 4 ewes),

although the better farms were carrying 3 to 3½ ewes. There were 48 holdings devoted to dairying and fat-lamb raising combined: the farms occupied a total area of 20,640 acres, of which 17,596 acres were in sown grass and 842 acres in fodder crops. The average (mode) size of farm classified on cultivated area was between 200 acres and 300 acres. The 58 holdings devoted to cattle-grazing were devoted to raising dairy heifers and fattening beef cattle.

In passing, it is interesting to notice the co-ordination in farm enterprises devoted to animal husbandry. The fat-lamb and cattle-fattening farms are co-ordinate with the extensive grazing-runs on surface-sown hill country—they utilize the old ewes from the grazing-runs for raising fat lambs and fatten the surplus sheep and cattle. The extensive grazier in turn depends on the intensive grazier for bulls and rams. The need for intensive grass-farms for fattening the surplus sheep and cattle from the surface-sown grazing country is now more important than it was in the past. When the forest land was being converted into pasture, the grazier sowed turnips and rape along with the grass-seed in his annual burns, and obtained bulky crops for stock-fattening. At present this is not possible, and there has been on most runs a gradual pasture-deterioration. The movement of stock from one area to another allows of specialization of enterprise. The extensive grazier regulates his stocking to the feed produced by his pastures, and fattening is carried out on farms where crops and good pastures can be cheaply produced. Specialization of enterprise is responsible for the existence of a long line of middlemen—transporters and dealers—between the enterprises producing store animals and the enterprises devoted to fattening.

OTOROHANGA COUNTY.

January 23rd, 1935: Kihikihi to Wharepuhunga.—The middle portion of Otorohanga County is on the plains of the Waipa—to the west it runs over the foothills of the Western Upland and in the south-east to the Central Plateau and the spurs of the Rangitoto Range. On the plains of the Waipa, farming-conditions are very similar to southern Waipa County—gently rolling hills and plains with dairy and fat-lamb farms. The farming of the higher country has not been quite as successful: ragwort is troublesome; much of the original grassing was done with false perennial rye-grass; areas have deteriorated; fern and ragwort have come in.

A very hot day after a long spell of dry weather and pastures burnt up. Visited a large farm where the original grassing had not been good, top-dressing somewhat neglected, and carrying-capacity declining. This year owing to the drought and the poor state of the pastures only 50 per cent. of the lambs were got away fat, and this has occurred in other places, and once pastures start to go back a drought hits them very badly. The farm consists of great grassed fields, rising here gently, there abruptly, from the stream valleys, with in places great cliffs and pinnacles of rhyolite. Originally fern and tutu land, the procedure in grassing had been to first burn and surface-sow, with or without surface cultivation, a temporary pasture of Italian rye-grass, cocksfoot, red and white clover:

red clover was the principal plant, and, with its strong summer growth, is excellent for crowding out fern and allowing of heavy summer stocking with cattle for fern-crushing.

At first sight bracken fern would appear to be impossible to eradicate, the fronds are unpalatable, the plants have great root development and grow with great rapidity. Yet with all its obvious advantages for holding possession of the ground it possesses four fatal defects that make its control possible. These are the incapacity of the underground stems to develop fronds except in specially defined places; the inability of the frond to grow when once broken off; the extreme ease with which the frond may be broken before it expands, or when it is in what is known as the curl stage; and the long dormant season extending from the autumn to the late spring(14). To control the fern and establish grass, the temporary pasture of Italian rye-grass and red clover is excellent; it allows of heavy spring and summer stocking, so that the young fern-fronds may be broken off in the curl stage and the fern crushed out.

On the deterioration of the temporary pasture and the disappearance of most of the fern the land was ploughed, sown in swedes, and then in permanent grass following swedes. Much of the permanent grassing was done before supplies of good certified perennial rye-grass seed were available—pastures are now poor, and ragwort has come in. The essentials in grassing this light country are good cultivation, the use of certified strains of rye-grass and white clover, and adequate top-dressing with phosphates. Good cultivation is important: the land should be ploughed with a lea mouldboard plough, rolled on the furrow, double-disked to a fine seed-bed, chain-harrowed to level the surface, and rolled before and after sowing seed and fertilizer. Rolling on the furrow with the Cambridge roller is most important: this rolling consolidates the bottom of the seed-bed and brings the soil moved by the plough again in contact with the unmoved subsoil, making a continuous firm layer of soil through which soil-moisture may move from the deeper layers to the surface. The usual grass-mixture consists of 20 lb. to 25 lb. certified perennial rye-grass, 8 lb. to 10 lb. cocksfoot, 2 lb. to 3 lb. crested dogstail, 2 lb. red clover, and 2 lb. white clover: the seed should be sown with 3 cwt. superphosphate, and thereafter top-dressed annually with 2 cwt. to 3 cwt.

Ragwort in much of the back country is a serious problem. On small intensively managed dairy-farms it can be kept under control by spraying and dusting with sodium chlorate. On larger farms sheep are necessary to help with control; but on farms where pastures have greatly deteriorated and ragwort covers most of the ground, ploughing followed by resowing appears to be the only feasible method of management.

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THE WINTER FEEDING OF STOCK IN CANTERBURY.*

FACTORS IN DAIRY-COW PRODUCTION.

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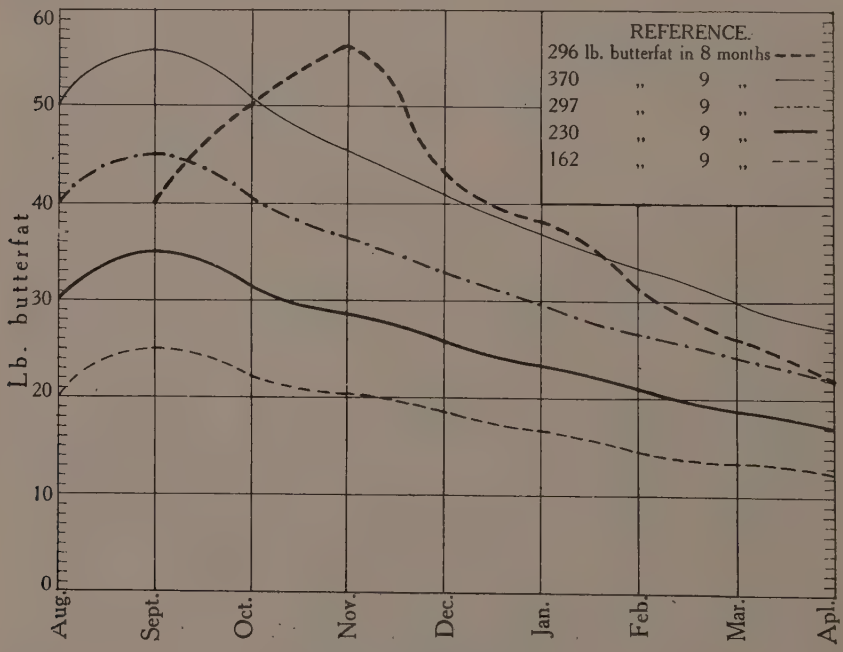
The winter feeding of stock is often discussed as though it were of itself the most self-contained aspect of stock-production. Many farmers feed their stock poorly in winter and get profitable returns, while others, who feed better in winter, get poorer returns. A consideration of these and allied facts makes it evident that winter feed must be considered not only by itself, but also in relation to the kind and quality of feeding, and the returns therefrom, during the whole year. The returns of butterfat per acre, per cow, or the cost of production per pound of butterfat are often used as measures of the level of production, and as such these are excellent standards of performance. They are not so helpful as to the reasons for high or low production. A more informative line of approach which displays both cause and effect is the lactation-curve.



Lactation-curves.

From an examination of the records of milk-recording societies in 1875 Gavin in England made a beginning with lactation-curves, and

* Substance of paper presented at the Conference of New Zealand Grassland Association at Christchurch, August, 1935.

these have since been further investigated in America and in England. A lactation-curve is a statement in the form of a graph, giving, in monthly or weekly periods, the yearly production of a cow, in pounds of butterfat, or pounds or gallons of milk. In the following, pounds of butterfat per month are used. It has been established that normal, well-fed cows attain their maximum production in the sixth to the eighth week after calving, and fall off in subsequent months at the rate of from 9 per cent. to 11 per cent. Thus for a production period of nine months the following would represent the normal yearly butterfat-production of cows at different levels. The lactation-curve of a Canterbury herd yielding 296 lb. of butterfat in eight months is also given.

While these curves are this shape for herds they may show much variation for individual cows. Some cows milk at the same rate for the whole twelve months, and others give 250 lb. fat in from four to five months, and then dry off. These are exceptions, since an examination of the performances of many herds makes it evident that the existence of such individual cows in no way invalidates the statement that lactation-curves of normal, well-fed herds conform to the shapes outlined above.

Graphs are difficult to reproduce, and for convenience throughout this paper the material will be presented in tabular form. The information in the preceding graph is set out in Table I.

Table I.

—	Pounds of Butterfat per Month of Normal Cows of Different Capacity (in Nine Months).				One Herd in Canterbury, 1930.
Augus	20	30	40	50	..
September	25	35	45	56	40
October	22·5	31·5	40·5	50·4	50
November	20·2	28·4	36·5	45·4	56
December	18·2	25·6	32·9	40·9	43
January	16·4	23·1	29·7	36·9	38
February	14·8	20·8	26·6	33·3	31
March	13·4	18·8	24·2	30·0	26
April	12·1	17·0	21·8	27·0	22
	162	230	297	370	296

These data are given for the purpose of demonstrating the fact that butterfat production at any level is not by nature a haphazard process. Some cows, even if well fed, are low producers, such as in column 1—162 lb. Most cows are low producers because of a departure from the above figures in two ways—first, through failure to reach maximum production until the third or fourth, or even fifth, month of the milking-season; and, second, through not milking for nine months. Of the cows examined in Canterbury, approximately 20 per cent. are good cows, sufficiently well cared for to be producing almost to their maximum. The returns of one such herd are set out in the last column. About 60 per cent. are equally good cows, but low-producing through unsuitable circumstances, and the remaining 20 per cent. are

naturally low producers. The above statement, as well as any that follow, is not meant to be a condemnation of Canterbury dairy-farming. It is a statement of the existing position. The information available does not allow of any comment on the profitableness of low or of high production. It does indicate the more important factors of cow-production.

Lactation-curves of Canterbury Herds.

During the years 1927, 1928, 1929, and 1930 the records of the production of a number of herds in Canterbury were investigated. A dairy company supplied the sales of butterfat, and herd-owners supplied calving-dates and numbers of cows milked each month. By dividing pounds of butterfat each month by the number of cows in milk each month for every herd, lactation-curves are obtained. This is an easy non-technical process. Some difficulty is experienced at the beginning and at the end of the milking-season, when the number of cows in milk varies from day to day, but, if records of calving and drying-off dates are kept, it is not difficult to find the average number of cows in milk for these months from the total cow-days of milking, divided by 30. If allowance is made for whole milk or butterfat used on the farm, the record will be so much the more accurate.

The pounds of butterfat produced by herds in Canterbury per cow in milk each month are set out in Table 11 for years 1927 to 1930.

Table II.—Canterbury Herds Four Years' Average Butterfat Production per Cow per Month.

Month.	1927.	1928.	1929.	1930.	Fifteen Herds recorded in	
					1927.	1930.
August	10·1	12·3	16·9	17·0	11·9	22·0
September	20·9	25·3	25·4	26·6	22·6	29·0
October	29·1	28·4	32·8	33·2	30·4	36·1
November	31·9	31·1	33·0	34·8	33·4	35·0
December	30·6	32·7	34·0	34·2	32·2	35·0
January	27·8	30·4	31·8	31·9	29·9	33·0
February	22·6	23·5	26·1	28·2	24·0	29·1
March	19·9	22·6	23·7	25·7	22·0	26·6
April	13·6	17·6	20·4	19·4	14·9	20·0
Totals	206·5	223·9	243·7	251·0	221·3	266·8
Number of herds ..	76	67	41	31	15	15

It will be seen that in every year the cows reach their maximum in November or December, and that from December onwards their production rate is comparable to that of 300 lb. cows (Table I).

In 1928–30 the production per cow in the last five months is 139 lb., 136 lb., and 127 lb. respectively. That of a 300 lb. cow is 135 lb. during the same period.

Canterbury cows are about 50 lb. to 60 lb. below their maximum nine-months-producing capacity, and this loss occurs in the first four months of the milking-season.

Some contend that the December or November maximum is a false one, due to late calvers that are in good condition and therefore high producers. Against this, the fact that production falls off after December in a normal way is presumptive evidence that there is nothing abnormal about the peak production. If it is admitted that high production is due to good condition of the cow, the critics and the writer are in agreement.

It will be seen from the totals that there is an improvement of 44·5 lb. butterfat per cow from 1927 to 1930. This may be due to the accidental examination in 1930 of better herds—*i.e.*, farms, or farmers, or better cows—than those examined in 1927.

As evidence that this is not the case, all the herds (fifteen) that were recorded in 1927 and again in 1930 were grouped each year, and the results are set out in the last two columns of the above table. These show an improvement of 45·3 lb. of butterfat and eliminates the factor of different farms, &c. Again, the improvements may be due to better cows. These fifteen herds contained 168 cows in 1927 and 180 cows in 1930, and it is reasonable to suppose that some of the 1927 cows were milking in 1930. None of these fifteen owners herd-test. Any replacements in these herds would be made with the same judgment or selection in 1930 as was used prior to that date, and new cows would therefore be of the same quality as cows already in the herds. The remaining and most probable cause of improvement is through better feeding, presumably occasioned by a consideration of information obtained from their own lactation-curves as supplied to them while the investigation was in progress.

Length of Time in Milk.

The second factor contributing to low production is a short milking-season. Some dairymen delay the calving of their cows until there is an adequate feed-supply, but all their cows calve in one month; others spread the calving over three or four months.

The practice may mean profitable dairying, but it is inimical to high production. Information about the length of time in milk of Canterbury cows is set out in Table III. This table has been prepared by finding the total cows in milk each month, calling the best month 100 and expressing all other months as a percentage of this.

Table III.—Percentage of Cows in Milk each Month.

Month.	Canterbury Herds in				1928.	
	1927.	1928.	1929.	1930.	Twelve Herds producing 136 lb. Butterfat.	Twelve Herds producing 266 lb. Butterfat.
August	25	19	20	12	5·5	29·0
September	47	44	47	52	34·0	67·0
October	77	77	80	86	69·0	92·0
November	93	94	97	92	90·0	96·0
December	100	100	100	98	96·0	100·0
January	100	100	99	100	100·0	100·0
February	98	100	99	99	99·0	100·0
March	96	96	95	97	97·0	98·0
April	92	96	93	95	86·0	98·0
Totals	728	726	730	731	676·0	780·0

In every year there is a gradual increase in the percentage of cows in milk each month, until the fifth or sixth month, when all cows have calved. There appears to be no lengthening of the season from 1927 to 1930. From the totals it is seen that in a nine-months season there is an effective milking-season equivalent to all cows for a period of $7\frac{1}{3}$ months—*i.e.*, about 80 per cent. of full-time efficiency. In actual production it means a loss of only about 10 per cent. owing to the fact that in the early part of the season those cows that are milking produce at a low level. The last two columns of Table III were obtained from the returns of the twelve lowest-producing herds and the twelve highest-producing herds in 1928. It will be seen that the high producers milk one month longer than the low producers, and half a month longer than the average.

Just as test and quantity of milk combine to give the product "butterfat per cow" so length of lactation and rate of production per month combine to give the same thing. The latter two factors are the only related variants in total yield that react to man's treatment of the animal.

Herd-testing has supplied information about individual cows in the herd, and also about length of lactation and production-levels from month to month. Probably its greatest value arises from the latter two pieces of information.

Length of lactation and rate of production, though variants in herd production, are not prime causes in it, since both are the effects of feed-supply and are controlled only by this. Consideration of the feed-supply is therefore of some importance.

Feed-supply.

For the purposes of translating tables of butterfat-production into tables of yearly feed-supply it is necessary to use the fundamental facts that the maintenance of a 1,000 lb. cow is 6 lb. of starch-equivalent per day—less for correspondingly lower weights—and that every pound of butterfat requires 6 lb. of starch-equivalent for its production. Using these figures, the feed-requirements for one month for a 1,000 lb. cow producing 40 lb. butterfat is 180 lb. of starch-equivalent for maintenance and 240 lb. starch-equivalent for production—a total of 420 lb. of starch-equivalent.

Cows that produce at their maximum capacity do so only when their weight remains constant within narrow limits throughout the year. Those producing below their maximum frequently do so because their live weight changes considerably (by perhaps as much as 30 per cent.). Thus cows of 1,000 lb. weight may come down to 700 lb. towards the end of the milking-season and during the winter and build up this 300 lb. as soon as grass is available in spring and early summer.

The first use to which spring feed is put by these cows is to build up body-reserves, and they cannot milk to capacity and store body-weight at the same time. For purposes of illustration it is assumed that the high producer maintains a constant weight and that the low producer varies in weight from month to month as indicated.

Few will dispute that a cow does vary in weight. No one is asked to believe that it does so according to the standards here set down as an example. Feed-supply—*i.e.*, the season—determines weight-change in amount and time.

Table IV sets out feed-supply of high and low producers in detail, allowing for weight-changes of the low producers and for variable maintenance appropriate to their weight. For the storage of 1 lb. of live weight, 2 lb. of starch-equivalent are required; the same weight lost gives out 1·66 lb. of starch-equivalent for production or for maintenance.

Table IV.

	High Producers: 300 lb. Butterfat, from Table I.				Low Producers: 206 lb. Butterfat, from Table II (1927 Group).					
	Starch-equivalent for				Starch-equivalent for					
Month.	Maintenance.	Production.	Total.	Percentage of Year's Total.	Live Weight.	Maintenance.	Production.	Change in Live Weight.	Total.	Percentage of Year's Total.
					lb.					
August ..	180	240	420	10·3	700	142	61	..	203	6·2
September	180	270	450	11·1	700	142	125	..	267	7·9
October	180	249	429	10·5	800	156	175	+200	531	15·8
November	180	222	402	9·9	900	169	191	+200	560	16·6
December	180	200	380	9·3	1,000	180	183	+200	563	16·7
January	180	181	361	8·6	900	169	166	−166	169	5·0
February	180	162	342	8·4	800	156	133	−166	123	3·6
March ..	180	146	326	8·0	850	163	119	+100	382	11·4
April ..	180	132	312	7·6	850	163	81	..	244	7·3
May ..	180	20*	200	4·9	800	156	20*	−83	95	2·8
June ..	180	40*	220	5·4	750	149	40*	−83	106	3·2
July ..	180	40*	220	5·4	700	142	40*	−83	99	2·9
Totals	2,160	1,902	4,062	..	..	1,887	1,334	..	3,346	..

* For production of calf.

The intake of the high producers is limited by their capacity to produce milk, while that of the low producers is limited by their stomach-capacity. This table is set out in full for the purpose of letting those interested see how the figures in the percentage columns are arrived at. There are differences that appear small, but in the following table it will be seen how important these differences are. Table V has been prepared by using the percentage columns of Table IV and setting down in columns 3, 4, and 5 the average, maximum, and minimum grass-growths each month as a percentage of total growth obtained over a four-year period at Lincoln College.

It will be seen from Table V that the monthly feed-requirement of the high producers, maintained at constant weight, shows little variation from month to month. It reaches a maximum in September and gradually falls off to a minimum in May. It is quite unrelated to grass-growth, and therefore has been arranged by the owner of the cows.

That of the low producers varies considerably from month to month, reaches one maximum in November and December, another in March, and drops to low levels in February and in May to June. It actually follows the graph of grass-production. In fact, the variations in grass-growth or other feed-supply determine the variations in live-weight change. The differences are well displayed in graphical form.

The low-producing cow, second column in Table V, loses weight during January and February while milking, gains a little in March when

the grass is better, and then loses weight in June and July. In Octobe r November, and December she returns to her normal weight. In doing this she uses much more feed than the constant-weight high producer in spring, and very much less feed in autumn. Some dairy-farmers maintain that this practice has many advantages, since it tends to keep grass-growth under control in spring, and certainly gets over the difficulty of poor grass in early autumn. By comparing columns 2 and 3 of Table V it appears, however, that on an average such a cow cannot eat all the grass that grows in November and December, and therefore that some waste must occur even in average seasons (a little hay is made).

Table V.—Percentages of Feed-requirement and Grass-growth for Twelve Months.

	Feed required each Month by Cows producing		Percentage of Grass-growth each Month for Four-year Period, 1927 to 1930.		
	300 lb.	206 lb. (1927 Group).	Average.	Maximum.	Minimum.
August	10·3	6·2	2	6	1
September	11·1	7·9	5	10	1
October	10·5	15·8	15	30	10
November	9·9	16·6	25	35	10
December	9·3	16·7	20	30	10
January	8·6	5·0	7	40	2
February	8·4	3·6	5	20	2
March	8·0	11·4	8	20	2
April	7·6	7·3	4	10	..
May	4·9	2·8	3	10	..
June	5·4	3·2	2	10	..
July	5·4	2·9	2	6	1

Maximum and minimum grass-growths are included in columns 4 and 5 to show the enormous variations that may take place in grass-growth and to emphasize the point that even though animals can be sufficiently accommodating to use the average grass-growth there are such wide departures from the average of monthly growth in different years that there must be waste of grass or starvation of cows unless reserves of feed are put by.

To some extent the low producer of varying live weight obviates the necessity of cutting hay or silage, but she also precludes the possibility of doing so, and consequently such cows that are in poor condition in winter give themselves the legacy of being low-producing in the following spring and of being starved in autumn. It therefore becomes difficult, and perhaps inadvisable, to lay the blame of low production at the door of winter feeding. It might be more reasonably charged against the general farm policy and the absence of feed in January and February, May and June, or other months when grass, the staple food, is in short supply. Wordsworth's lines, "Getting and spending, we lay waste our powers," might have been meant for the dairy cow.

It is an age-old practice, most convenient to mankind and indispensable to the very existence of the animal, for the animal to use its body as a storehouse for its own feed-supply. The more highly exploited and artificial the existence of the animal the more it is necessary for man to organize its feed-supply, and, if dairy cows are to be high-producing, organization of the feed-supply is a most urgent problem. Attention to this by those interested in the industry has already been the biggest

factor in success, and it must be productive of the most immediate progress where it is now not adequately attended to. Evaluation of the aptness of the present feed-supply can be made most easily from a consideration of the herd lactation-curve, or from information obtained from actual measurement of cows, as an index of live-weight status.

When animals are used excessively as storehouses it not infrequently happens that, owing to the apparent need of a winter-feed supply, undue expense is incurred on this in a tardy attempt to build up the animal that has become too low in condition, with a consequent reduction in the grass-area or spring-feed supply, and therefore a reduction in the output of saleable animal products.

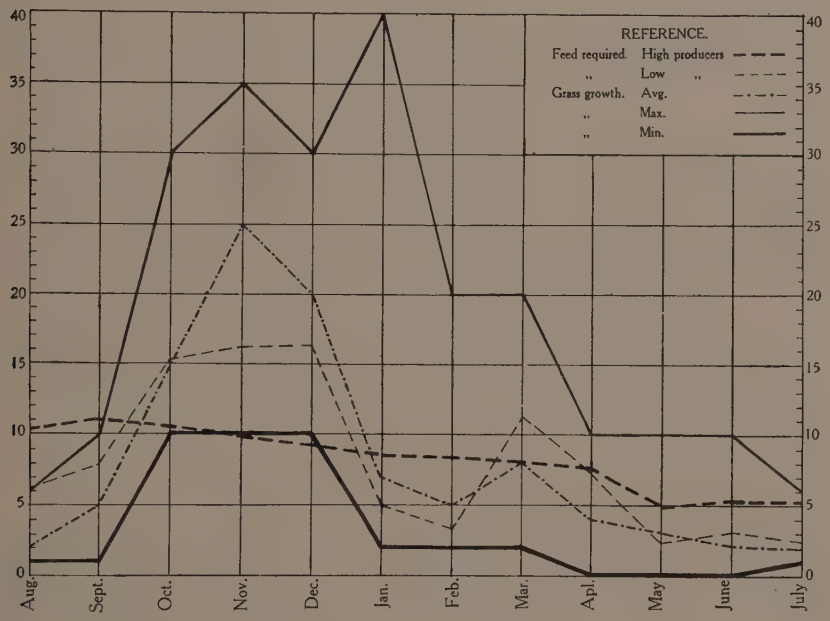


FIG. 2. GRAPHICALLY DEPICTS THE DATA CONTAINED IN TABLE V.

Efficiency of Feed Conversion.

One further aspect of feed utilization that may negative the value of otherwise excellent feeding is the amounts of feed that are used for maintenance and for production purposes. Those who keep cows do so for profit, and usually attempt to keep such a number that their profits are as great as possible. In his bulletin, No. 138, New Zealand Department of Agriculture, on dairy-farm management, Fawcett produced figures to show that the greater the number of cows per acre the greater the production per acre, that cows per acre is a cause of returns per acre, and that high-producing cows, while valuable, tend to be over-exploited as a factor in high per-acre production. His contentions require consideration in the light of fundamental principles.

Reverting to Table IV, it will be seen that the high producers consume 4,062 lb. of starch-equivalent, and convert 1,802 lb. of these into butterfat (100 for calf-production). This means that they are converting

44·5 per cent. of all the feed that they eat into butterfat. The butterfat production on any farm is determined by two most basic factors, both under the control of the owner. The first is the amount of feed that grows and the second the percentage of this that is turned into butterfat.

The owner has some control over the first by the kind of pasture or crop he uses, and the top-dressing and treatment he gives them ; over the second by the quality of the cow he uses, the number he keeps, and the way he organizes their feed-supply. Cockayne first indicated the importance of this aspect of cow production in the *New Zealand Journal of Agriculture*, Vol. XXIII, p. 65, and most dairy-farmers were quick to realize the importance of reducing the number of cows in order to get higher total production of butterfat. Fawcett appears to have drawn a wrong inference when he suggests that high production per acre is due to high cow-numbers per acre. If we take Table I of his bulletin and translate his cow-numbers and pounds of butterfat per acre into feed produced per acre, we get the following :—

Table VI.

Average Butterfat per Acre. Bulletin No. 138, Table 1.	Feed used per Acre for producing Starch-equivalent. (In Pounds.)	Cows carried per Acre. Bulletin No. 138, Table 1.	Feed used per Acre for Cow-maintenance (In Pounds, Starch-equivalent.)	Total Feed produced per Acre. (In Pounds, Starch-equivalent.)	Percentage turned into Butterfat.
	Butterfat × 6.		Cows × 2,200.		
161·9	971	0·535	1,177	2,148	45·2
139·0	814	0·490	1,078	1,892	43·0
119·5	717	0·440	968	1,685	42·5
99·6	597	0·382	840	1,437	41·1
81·9	491	0·338	743	1,234	39·8
63·8	386	0·293	644	1,030	37·5
38·0	228	0·198	435	663	34·4

It will be seen that the farms compared vary in production per acre from 2,148 lb. of starch-equivalent down to 663 lb. of starch-equivalent per acre, and the percentage of this that is turned into butterfat varies from 45·2 per cent. on the high-production farms down to 34·4 per cent. on the low-production farms. If the efficiency of conversion of the lowest-producing farms was as good as that of the highest-producing, the lowest-producing farms would be carrying 0·164 cows to the acre and producing 50 lb. of butterfat per acre, an improvement of about 30 per cent. in per-acre production by reducing cow-numbers per acre by about 16 per cent. The fact that high correlations are obtained between butterfat per acre and cows carried per acre means little, since both these items are merely consequences of the amount of grass that grows and of the efficiency with which it is converted into butterfat. The percentage of grass turned into butterfat on average dairy-farms would appear to be about 40 to 42 and the maximum about 50 to 52 for farms quoted in Bulletin No. 138. Some slight improvement is still possible in this direction, even in the North Island. If the number of cows in milk is multiplied by 2,200, and the pounds of butterfat sold multiplied by 6, the sum of these two amounts is the total feed used by the cows. The precentage efficiency is then found by dividing the product " butterfat multiplied by 6 " by the total feed used. When a man knows this efficiency he knows how much attention to give to his feed-supply.

THE POTATO-TUBER MOTH.

(PHTHORIMAEA OPERCULELLA, ZELL.)

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THE potato-tuber moth, *Phthorimaea operculella* Zell. (*Lita solanella* Boisd.), referred to by Kirk in a departmental leaflet published in 1894, had apparently been in New Zealand for a considerable number of years prior to this date. Its importance as a pest during any year is influenced largely by climatic conditions, dry seasons especially favouring its increase and consequently its destructiveness. During the long dry summer of 1934–35, for example, the moth increased enormously and caused considerable losses to potato-growers, especially to those near Auckland.

THE DIFFERENT STAGES OF THE MOTH.

The adult insect is a small, inconspicuous, greyish, night-flying moth which measures approximately $\frac{1}{2}$ in. in length. It is a weak flier, and when it is disturbed it travels but a short distance, pursuing an erratic course from one plant to another in an endeavour to conceal itself. It lays its small, rounded, pearly-white eggs on the leaves or stems of the host-plant, or they may be laid in cracks or in the eyes of the potato-tuber itself. The small whitish larva or tiny caterpillar which emerges from the egg measures approximately $\frac{1}{25}$ in. in length, and when full-grown it is $\frac{7}{16}$ in. to $\frac{1}{2}$ in. long. The full-grown larva has a dark head capsule; the first two thoracic segments are light brown in colour, while the remainder of the body may be white or tinged a faint greenish or pinkish colour. The larva is very active and wriggles violently when disturbed. When ready to pupate the caterpillar leaves its burrow or mine and pupates in the soil, or among plant debris, or even between leaves of the host-plant, which it firmly ties together by means of numerous fine silken strands. Under storage conditions it pupates amongst the potatoes or on the sides of the bag or bin or other container in which the potatoes are kept. The pupa, from which the moth later emerges, is a small, spindle-shaped object which is usually protected by a finely-woven silken cocoon.

LIFE-CYCLE.

Specific life-history studies of the insect in New Zealand have not been made, but all stages of the moth may be found throughout the different seasons of the year. In the United States of America Spencer and Strong (1925) have shown (Table A) that the length of the life-cycle of the moth may vary from 27 to 159 days; they found that the cycle shortens as the mean temperature rises.

Table A.—Table showing Temperature Influence on Length of Life-cycle of the Moth (Egg to Adult).

Series.	A.	B.	C.	D.
Temperatures, degrees F.				
Maximum	69	78	82	79
Minimum	38	52	63	65
Mean	56	65·4	70·5	72·2
Life-cycle, days—				
Minimum periods egg to adult..	55	36	35	27
Maximum periods egg to adult	159	75	50	45

—After Spencer and Strong.

Injury.

All portions of the potato plant—*i.e.*, the stems, the leaves, and the tubers—are subject to attack by the moth. Injury to the stems is caused by the larvæ burrowing into them; this has the effect of checking the flow of plant-sap, and thereby causes the plants to wilt and die. The characteristic blistered appearance of the leaves is brought about by the larva boring into them and eating out the tissue between the upper and lower surfaces. Leaves of tobacco are attacked in a similar manner, with the result that the mines formed weaken the tobacco-leaves and cause them to split when used as "wrappers" of cigars. It is for this reason that it received the name of "tobacco split-worm" in the United States of America. Until recently it was thought that the tobacco split-worm was possibly a different insect from the potato-tuber moth, but the work of Spencer and Strong (*loc. cit.*) on cross-breeding and life-history experiments, coupled with careful morphological comparisons of adult specimens, showed that they were identical.

Attacks on the tubers may take place in the field, but only those which are exposed by cracks in the ground, or through poor "earthing up," are likely to become infested. The larvæ usually seek some depression or dent in the potato-surface in which to commence boring, the potato-eyes, for example (Fig. 1), being favoured points of entry. Once inside the tuber they appear to bore indiscriminately through the flesh; the burrows formed become packed with frass and permit the entry of disease organisms, which subsequently cause the potato to decay. Typical tuber-injury by the grub is shown in the accompanying figure (Fig. 2).

Preventive Measures.

The time-worn phrase "prevention is better than cure" is equally important as a means of preventing damage by the potato-tuber moth as it is for the prevention of damage by many other insect pests. The ground should be cultivated to a fine tilth before planting the potatoes; unless it is thoroughly worked it tends to crack and open up during a dry spell, thus providing an entrance for the moths or their larvæ, these latter frequently migrating from the withered tops in search of a fresh food-supply. It is advisable to plant clean seed; planting should be deep, and during the growing-period the potatoes should be well hilled.

Before digging-operations commence, especially in a field where the moth is very prevalent, it is advisable first to go through the crop and remove and bag exposed tubers, which are almost certain to be infested by the pest. Following digging-operations the potatoes should be bagged immediately; the bags should then be sewn up and removed without delay to suitable storage. The practice of covering the mouths of the bags with potato foliage and allowing them to stand in the field cannot be too strongly condemned, since the grubs are likely to leave the foliage and infest the potatoes in the bags. Growers should take every precaution to prevent storage infestation by the moth since it is likely to do more damage under such conditions than elsewhere.

Following the harvesting operations all old potato-foliage left lying about should be raked up and burnt. Similarly, all cull potatoes

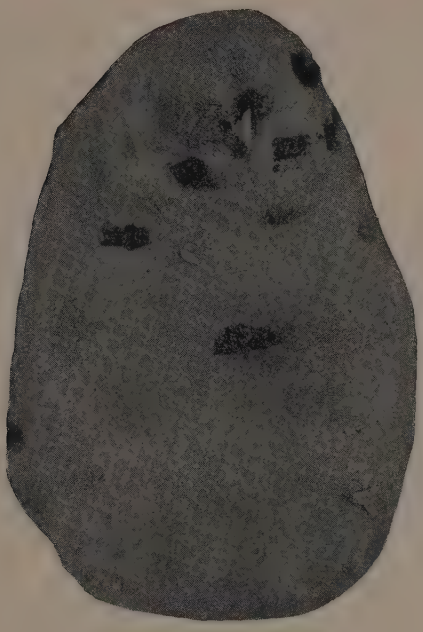

FIG. 1. THE DARK PILES OF FRASS IN THE POTATO-EYES INDICATE PLACES OF ENTRY BY THE LARVÆ.

FIG. 2. POTATO CUT IN HALF TO SHOW TUBER-MOTH INJURY.

should be collected and in some manner, such as feeding them to pigs, they should be completely disposed of. Field sanitation-methods and the removal of stray potatoes, whether from field or from round about the places of storage, are all important aspects of prevention which are commonly neglected.

Control Measures.

In spite of the many precautions taken an outbreak of the pest occasionally occurs, and in order to control it the use of a fumigant such as carbon bisulphide may prove necessary. Until detailed experiments are carried out concerning the ultimate effect of carbon bisulphide on seed potatoes its use for this purpose seems inadvisable at present. Storage tubers, however, may be treated with carbon bisulphide at the rate of 5 lb. of the liquid to every 1,000 cubic feet of space to be fumigated. The period of time over which the potatoes are exposed to the fumigant should not exceed eighteen hours. Excessive quantities of the fumigant or extended periods of exposure to its action may cause the complete collapse of the potato flesh. Carbon bisulphide is highly inflammable and explosive when mixed with air, and for this reason must be used with caution. A flame of any kind, a lighted cigarette, or even a spark from hitting metal on metal, or from an electric switch, may cause an explosion of the gas. Carbon bisulphide causes dizziness and nausea if inhaled and is fatal if breathed in sufficient quantities; it has a deleterious action on the heart, so that people with weak hearts should not handle it. Since the fumigant is more than two and a half times heavier than air and tends to fill a room in very much the same way that water would fill it, the room should be made as air-tight as possible, especially around the sides and bottom.

Fumigation may be conducted in the field by loosely stacking the potatoes and covering them with a large tarpaulin the edges of which should be carefully covered all around with loose earth. It is inadvisable to fumigate with the temperature below 60° F., and best results will be obtained at temperatures from 75° to 90° F. A second fumigation may be necessary in ten or fourteen days in order to kill any larvæ or moths which might emerge from the eggs and pupal stages.

Seed Potatoes.

The grower who keeps his own seed potatoes should select only clean material, which should be kept bagged and stored in a place free from the moth. The practice of greening the seed by spreading it out in the open during the autumn or warmer months of the year must be strongly condemned as such a practice is conducive to serious moth attacks. The greening operation should be delayed until the cold weather sets in, when the moth is inactive and unlikely to spread.

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FARMERS' FIELD COMPETITIONS.

CANTERBURY (NORTHERN A. AND P. ASSOCIATION) RESULTS, 1934–35 SEASON.

J. G. McKAY, Fields Instructor, and C. C. LEITCH, Instructor in Agriculture, Christchurch.

THESE competitions were continued as in previous seasons and embraced turnips, mangolds, green feed, and lucerne. Turnips included both white-fleshed and yellow-fleshed varieties all judged as one class, the comparatively small number of entries usually received hardly warranting a distinction being made between varieties. In the mangold competition provision was made this season for two classes, one on land of any value and the other on land valued at less than £25 per acre. Green-feed crops were divided into two classes, including crops on land of any value (the value of the land to be taken into consideration), and those on land of any value from which a grain crop has been taken during the season. The lucerne competition comprised stands of varying ages all judged as one class.

TURNIPS.

Turnip entries totalled four, as against six for the previous season, and yields were on the average lower, there being a difference between the two winning crops of 11 tons per acre in favour of last season. These differences are to some extent attributable to seasonal conditions, but it is interesting to note that the crops placed first and second last season were sown in 7 in. instead of 14 in. rows, a factor which may have a considerable influence upon yield, as indicated by experiments conducted by the Department in Canterbury and elsewhere, the results of which are supported by weighings taken in these field competitions, where turnips sown in 7 in. rows have invariably yielded better than those in 14 in. rows on similar soils and methods of cultivation.

The winning crop was grown by Mr. F. A. Sheat, Horrelville, Mr. C. Lassen, Oxford, being second, and Mr. R. F. Henderson, Oxford, third. The crop securing first place consisted of a mixture of Imperial Green Globes, Red Paragons, and Green Top Yellow Aberdeens, sown early in January at the rate of 7 oz. per acre through alternate coulters of the drill (14 in. rows) with carbonate of lime and superphosphate mixed in equal parts at the rate of 1 cwt. per acre. The crop followed green feed; the land was ploughed early in October and received six grubbings and one stroke each of harrows and grubber prior to sowing. Second place went to a crop of Imperial Green Globes sown on land ploughed out of old grass pasture in August. A good seed-bed was prepared with disk harrows, cultivator, and tine harrows; the land was rolled, and 8 oz. of Imperial Green Globe seed was sown early in January through alternate coulters of the drill, with superphosphate and carbonate of lime mixed in equal parts and sown at the rate of 2 cwt. per acre.

The crop placed third also followed grass. The land was ploughed in September, a seed-bed was prepared with disks, grubber, and harrows, and 11 oz. of Green Top Yellow Aberdeen seed per acre was sown early

in January through alternate coulters of the drill, with carbonate of lime and superphosphate mixed in equal parts and sown at the rate of 2 cwt. per acre.

Points awarded the winning crops were as follows:—

Competitor.	Distance between Rows.	Variety.	Yield, in Tons.	Yield Points: 60.	Quality: 20.	Evenness of Crop: 10.	Freedom from Weeds: 10.	Total: 100.	Placing.
	In.								
F. A. Sheat, Horrelville	14	Imperial Green Globe, Red Paragon, Aberdeen Green Top Yellow	29	50	18	8	9	85	1st
C. Lassen, Oxford ..	14	Imperial Green Globe ..	25	46	20	9	9	84	2nd
R. F. Henderson, Oxford	14	Aberdeen Green Top Yellow	27	48	18	8	6	80	3rd

These crops were judged in May, and the roots at that time were practically free from dry rot. All were sown about the same time, early in January, and contrary to what might be expected Imperial Green Globes were in some instances superior in quality to Aberdeen Green Top Yellows, the latter variety having become somewhat spongy. In one instance a small percentage of club-root was present, due to growing cruciferous crops too closely in the rotation. In North Canterbury this disease is not regarded so seriously as in other parts, but the case mentioned emphasizes the advisability of keeping such crops fairly wide in the rotation.

The carbonate of lime and superphosphate mixture used with all three crops has given such satisfactory results as a fertilizer for turnips and similar crops in Canterbury that its use has become fairly general.

Mangolds.

In the mangold competition a total of eleven crops were entered, being one less than last season, and, as previously stated, an additional class was provided for, on land valued at less than £25 per acre. Some exceptionally good yields were recorded, the winning crop on the higher-priced land yielding 130 tons per acre, a phenomenal yield for Canterbury, whilst yields on the lighter soils compared more than favourably with the best in the turnip competition. Considering the dry season experienced, yields as a whole were remarkably good, and crops in the main were very even and comparatively free from weeds.

In Class 1 (land of any value) the placings of the competitors were—Estate of R. Petrie, Woodend, first; R. McDonald, Waikuku, second; and A. J. Rich, Kaiapoi, third.

First place went to a crop of Yellow Globes sown in 20 in. rows without fertilizers. This was an exceptionally heavy crop, and followed potatoes.

A crop of Prizewinner Yellow Globes gained second place. This crop was sown on land ploughed out of grass, and received superphosphate and carbonate of lime at the rate of 2 cwt. per acre as a fertilizer. This crop was somewhat uneven owing to dry weather in the early stages of growth.

Third place was secured by a crop of Rich's Intermediates sown in 23 in. rows without fertilizers on land which had grown an onion crop the previous season. This was a very even crop, and was practically free from weeds.

Class 2, on land valued at less than £25 per acre, drew three entries only, and placings were—H. E. Evans, Fernside, first; W. Atkinson, Ohoka, second; and J. F. Dawson, Fernside, third.

In this class Golden Globes secured first place. The crop was sown in 28 in. rows, with superphosphate at 2½ cwt. per acre and approximately 2 tons per acre of farm-yard manure.

A crop of Orange Globes secured second place. The crop which was sown in 28 in. rows had a higher yield than the crop placed first, but was not so even or so free from weeds.

Third place also went to a crop of Orange Globes sown in 28 in. rows, with 6 cwt. of super drilled and broadcast. This was a very clean, even crop, but suffered from lack of moisture.

Placed crops in these two classes are as follows:—

½ *Acre Mangolds: Land of any Value.*

Competitor.	Distance between Rows, in Inches.	Variety.	Yield, in Tons.	Yield in Points: 60.	Quality: 20.	Evenness of Crop: 10.	Freedom from Weeds: 10.	Total: 100.	Placing.
	In.								
Estate R. Petrie, Woodend	20	Yellow Globe ..	130	60	17	8	9	94	1st
R. McDonald, Waikuku	20	Sutton's Prizewinner ..	120	55	18	7	8	88	2nd
A. J. Rich ..	23	Rich's Intermediate ..	93	41·5	19	10	9	79·5	3rd

Green-feed Crops.

In the green-feed classes some good areas of feed were to be seen, and the total of twelve entries can be regarded as satisfactory considering the comparatively dry season.

It may be stated that no competitor has so far grown a green-feed crop specifically with the object of entering it, or portion of it, in these competitions, and it naturally follows, therefore, that a competitor who happens to be utilizing a field in particularly good heart, such as grass-land under fallow, has an advantage over others who of necessity, or other reason, are growing on land after a grain crop, perhaps necessitating a more or less hurried preparation of the land for green feed. The benefits of early and thorough land-preparation cannot be denied, but whether feasible or economically sound in all instances are questions which the farmer himself is best able to decide.

Class 1: Best 5 Acres Green Feed (Land any Value), Value of Land to be taken into Consideration. Nine Entries.—The winners of this class

were H. B. Catherwood, Springbank, first; R. L. Anderson, Bennets, second; M. Spencer-Bower, Swannanoa, and Frizzell Bros., West Eyreton, third (equal).

Mr. Catherwood sowed Algerian oats on land ploughed out of grass in October. Following cultivation with grubber and harrows, the area was again ploughed in February, a seed-bed prepared, and sown with 2 bushels of Algerian oats and 1 cwt. of turnip manure per acre.

Mr. Anderson sowed Italian rye-grass (certified) on land which had grown a wheat crop the previous season. The land received three ploughings in all; a seed-bed was prepared with grubber, harrows, and roller, and 25 lb. of Italian rye-grass per acre was sown broadcast in March, with 1 cwt. of superphosphate.

Frizzell Bros. sowed Algerian oats on land ploughed out of grass in October. The land received a further ploughing in December, and the oats were sown about the middle of February at the rate of 2¼ bushels per acre, with ¾ cwt. of superphosphate.

Mr. M. Spencer-Bower sowed a mixture consisting of 1 bushel of perennial rye-grass, 1 bushel of oats, and 1½ lb. of rape on land ploughed out of grass in September. A seed-bed was prepared with cultivator and harrows and the seed sown early in March.

Points were awarded as follows:—

Competitor.	Strike Points: 30.	Evenness: 20.	Condition and Yield: 25.	Freedom from Weeds: 25.	Total: 100.	Placing.
H. B. Catherwood, Springbank	28	19	24	23	94	1st.
R. L. Anderson, Bennets ..	28	18	23	24	93	2nd.
M. Spencer-Bower, Swannanoa	28	18	23	23	92	3rd equal
Frizzell Bros., West Eyreton	28	17	23	24	92	3rd equal

Class 2: Best 5 Acres Green Feed on Land of Any Value that has had a Grain Crop taken from it during the Season.—This class drew three entries only, and placings were—F. A. Sheat, Horrelville, first; Jas. Petrie, jun., Swannanoa, second; and G. H. Hassall, Clarkville, third.

Mr. Sheat's entry consisted of Algerian oats and Cape barley following a wheat crop. The land was ploughed immediately after harvest, worked down with tine harrows, and sown with 1 bushel each of Algerian oats and Cape barley about the end of February, with lime and superphosphate in equal parts at the rate of 1 cwt. per acre.

Mr. Petrie's entry consisted of perennial rye-grass and Algerian oats following an oat crop. The land was ploughed, grubbed, four times harrowed, and rolled three times, drilled and cross-drilled with 1 bushel each of Algerian oats and perennial rye-grass early in March, with superphosphate at the rate of 1½ cwt. per acre.

Mr. Hassall's entry consisted of Western wolths following an oat crop. The land was ploughed in February and a seed-bed prepared with cultivator and tine harrows. Western wolths at the rate of 1½ bushels per acre was drilled and broadcast early in March, with ¾ cwt. of superphosphate per acre.

Points awarded were as follows :—

Competitor.	Strike Points: 30.	Evenness: 20.	Condition and Yield: 25.	Freedom from Weeds: 25.	Total: 100.	Placing.
F. A. Sheat, Horrelville ..	29	19	23	24	95	1st
Jas. Petrie, jun., Swannanoa ..	29	20	21	24	94	2nd
G. H. Hassall, Clarkville ..	28	19	20	24	91	3rd

Lucerne.

The lucerne competition drew a total of eight entries, compared with ten last season, and the following points were awarded the winning stands :—

Competitor.	Purity: 25.	Quality of Crop: 25.	Density and Field Capacity: 50.	Total: 100.
G. M. Dixon, Amberley ..	24	24	46	94
A. G. Stewart, Coldstream ..	24	24	45	93
W. Stalker, Rangiora	24	23	44	91

Entries comprised stands varying in age from one year upwards, and included some excellent areas of lucerne. Naturally the younger stands were at a disadvantage in competition with fully established ones, but the number of entries so far received in the competition has scarcely warranted a distinction being made, and it has therefore been the custom to include all crops in one class. First place went to a four-year-old stand showing plenty of vigour, and those placed second and third were both two-year-old stands which have not yet reached their maximum productivity.

The Fields Superintendent, Christchurch, advises that in many parts of Canterbury cocksfoot is coming into much greater favour than has been the case of recent years. Many farmers on the plains, who have been endeavouring to grow only rye-grass pastures, find that under the normal summer climatic conditions of Canterbury the rye-grass does not produce any feed worth-while after about the middle of December and, in the case of the poor types of rye-grass, the greater part dies out during the periods of drought. The certified rye in most cases holds on, but is quite dried up. The cocksfoot pastures produce a certain amount of summer feed and very good early autumn feed, and for this reason cocksfoot is finding favour with many farmers who previously sowed nothing but rye-grass.

Parasitic Disease in Young Cattle.—The prevalence of parasitic disease in calves is responsible for considerable loss. Much information on the prevention and treatment of the trouble has been disseminated, yet it is difficult to bring about a realization of the efficacy of good feeding and management. Referring to this point the District Superintendent, Auckland, remarks : " Parasitic diseases among young stock are far too common in spite of the information imparted to farmers on the prevention and treatment of these troubles. Owners are far too prone to rely on all kinds of medicines, but lose sight of the fact that good feeding and careful management, especially during the winter months, play a big part in assisting calves to overcome these troubles."—*Annual Report, Director, Live-stock Division.*

ELLESMERE FARM-MANAGEMENT COMPETITION, 1934-35.

UNDER THE AUSPICES OF AGRICULTURAL AND PASTORAL ASSOCIATION.

I. W. WESTON, Economist, Canterbury Agricultural College, Lincoln.

THE late Mr. Job Osborne donated the sum of £150 to the Ellesmere Agricultural and Pastoral Association to enable that association to award prizes for the best-managed farm in the district. A sub-committee, comprising Messrs. R. T. MacMillan, T. O. Stephens, W. O. Rennie, and, later, P. V. Bailey, was set up, and, working in conjunction with the writer, and after obtaining particulars as to the method of running similar competitions in Otago, Southland, and Palmerston North, the following conditions and rules were finally drawn up:—

1. Entries open to farmers resident in the Ellesmere, Springs, and Selwyn Counties farming an area exceeding 45 acres.

2. Competitions to be judged under the following headings:—

	Points.
(*a*) Land in good heart	100
(*b*) Farm conducted on a permanent plan	100
(*c*) Cleanliness of land and freedom from weeds ..	100
(*d*) Stock suitable to the farm	150
(*e*) Buildings, plant, fences, &c., in good order and suitable	150
Total general points	600
(*f*) General and profitable management of the farm (profit and loss)	400
Total points	1,000

3. Competitions to commence at the beginning of the financial year, about 1st July, and to close about 30th June, at the end of the financial year. Entry fee, 7s. 6d.

4. Information required from competitors to be treated as strictly private. No confidential information or details of private position required, but merely a record of the year's farm receipts and payments.

5. Prizes: Eight entries or more—1st prize, £15 15s.; 2nd prize, £5 5s. Less than eight entries—1st prize, £10 10s.; 2nd prize, £4 4s. Three entries, or no competition.

In 1933 three entries were received, and it was decided, with the consent of the competitors, to postpone the competition to 1934. In this year thirteen entries were received. Ten further tentative entries were received, but, owing to the very unfavourable season, particularly on the heavy land, these entries were withdrawn.

The judges appointed were Mr. McIntosh and Dr. Hilgendorf (in his absence, Mr. Calder) as judges of general points, and the writer in respect to profit and loss. The farms were inspected in November–December, and general points were awarded. At the end of the financial year the "profit and loss" points were added, and the five leading

farms again inspected for confirmation of the general marks previously awarded. The leading farm was Mr. A. C. Greenwood's (Southbridge), with Mr. J. Johnstone (Tai Tapu), Jos. Brooks (Irwell), and G. W. Tyson (Springston) next in that order.

In the judging of the profit and loss any possibility of individual bias was eliminated by basing the results entirely on returns such as are required for proper accounting. Certain adjustments were made to the Profit and Loss Account returns:—

(1) Any alteration of income due to the inclusion of returns for the previous year's production was allowed for.

(2) Irrespective of whether or not wages were actually paid, wage rates for permanent labour were standardized on a basis of—

10s. per week plus 15s. keep for each boy working between 15 and 17 years of age.
15s. per week plus 15s. keep for each boy working between 17 and 19 years of age.
20s. per week plus 15s. keep for each boy working between 19 and 21 years of age.
25s. per week plus 15s. keep for each man working over 21 years of age.

(3) Wages for the owner, occupier, or manager were allocated at the rate of £100 per annum plus 1 per cent. of the total assets handled—*i.e.*, where the total valuation of the land, stock, and plant was £10,000, wages of management charged would be £100 plus £100 —*i.e.*, £200 per year. This low rate was decided upon because it was considered that a farm worker who had the opportunity to lease a farm as a going concern would be advised to do so provided he estimated the rent would permit him to secure but little more than present wages.

(4) The land used, whether rented, indebted, or free of debt, was valued at a conservative present market-value basis—

Light plain land being valued at £3 to £5 per acre.
River-bed grazing being valued at £6 to £10 per acre.
Dry wheat land being valued at £15 to £25 per acre.
Heavy wheat land being valued at £25 to £40 per acre.

The majority of the heavy land was valued at £35 per acre, with some of the heaviest and best at £40 per acre.

The stock was valued at a standard low basis of £1 per head for sheep, £2 per head in the case of stud sheep, £5 per head for cattle, £10 per head for stud cattle, £2 per head for pigs, and £20 per horse carried.

Implements and plant were valued on a conservative basis.

(5) Since interest and land-tax vary according to the financial position of the occupier, both these items were excluded from the expenses. Depreciation, at standard rates, was included as an expense.

(6) From the gross farm income, say, £1,000, total farm expenses including wages of management, say, £600, were deducted, and the balance, say, £400, obtained. The balance was then expressed as the rate per cent. earned on the total valuation—*e.g.*, if the total valuation was £10,000 the rate earned on £400 = 4 per cent. of total valuation. For the year no return was higher than 10 per cent. For a return of 1 per cent. 40 points were awarded, so that a return of 10 per cent. would earn the maximum points, 400.

Average Results, 1934–35.

The following table summarizes the results obtained during the 1934–35 competition :—

—	Average, all Farms.	Four most profitable.	Four least profitable.
Acres (range, 50 to 600 acres)	256	242	212
Valuation of—			
Land (range, £3 to £40 ; average, £27 10s. per acre)	7,053	7,094	5,646
Sheep at £1, stud sheep at £2	445	690	200
Cattle at £5, stud cattle at £10	120	70	100
Pigs at £2	7	3	10
Horses at £20	152	167	135
Implements and plant	413	286	305
Total stock and plant (average, £4 10s. per acre)	1,137	1,216	750
Total valuation (average, £32 per acre)	8,190	8,310	6,396
Gross income from—			
Cattle (range, £5 to £8 ; average, £7 per cow)	100	56	102
Sheep (range, 16s. 8d. to 27s. 6d. ; average, 23s. 6d. per head)	351	494	168
Pigs (range, £20 to £50 ; average, £24 per sow)	41	30	57
Horses (range, loss to £20 ; average, £2 10s. per horse)	20	4	10
Total income from live-stock (average, 172 acres in grass and fodder crops = £3 per acre)	512	584	337
Crops (average, 84 acres in crop = £7 per acre)— Wheat, 37 acres at 28 bushels ; barley, 10 acres at 47 bushels ; peas, 15 acres at 17 bushels ; rye-grass, 15 acres at 42 bushels ; clover, 7 acres at 200 lb.	598	677	465
Total income (average = £4 7s. per acre)	1,110	1,261	802
Less farm expenses (average = £2 1s. per acre)	523	419	490
	587	842	312
Less wages of management (average, 14s. per acre)	182	183	164
Balance (average, £1 12s. per acre)	405	659	148
Balance expressed as percentage of total valuation	5	8	2·3
Points awarded	200	320	92

Remarks.

On the basis of the average returns set out above two further calculations can be made :—

—	Average all Farms.	Four most profitable.	Four least profitable.
(1.)			
Income (less farm expenses, excluding wages of management)	587	842	312
Less 5 per cent. interest on total valuation	410	415	320
Balance for management and profit	177	427	—8
(2.)			
Income (less farm expenses, including wages of management)	405	659	148
Balance capitalized at 5 per cent.	8,100	13,180	2,960
Less valuation of stock and plant	1,137	1,216	750
Balance, maximum amount on which interest-payment possible, on land at 5 per cent.	6,963	11,964	2,210
Balance equals a per-acre value of	£27	£49	£10

The number of acres per man working averaged 106.

With regard to the farm competition the following points may be noted: The most profitable farms for the year were the highest valued, had the highest investment in stock, the least investment in machinery, and the lowest costs. The winning farm grew a good yield of certified white clover and good yields of certified Italian and perennial rye-grass. Special care was taken to develop the land into good heart before sowing the white clover, and the success of this crop largely contributed to the success of the whole farm. This farm also grew much more lucerne than the other farms. A special use of mangels was made, the mangels being fed to the stock in the late spring so as to allow an extra paddock to be shut for grass-seed harvest. By extra care at lambing, special lambing-hutches being provided and the ewes being herded into small sheltered areas and inspected with the aid of a torch at intervals during the night, a large percentage of lambs was obtained from the stud Southdown ewes carried. The highest butterfat return per cow was also obtained from the Jersey cattle carried.

The main feature of the second farm was the high returns obtained from pigs and potatoes. A gross income of almost £100 was obtained from the production of two sows.

The third farm secured the second highest total for general points, but the season was not favourable to specially high net returns. The yields of wheat and of garden-peas were less than expected, but very good returns were obtained from the sheep, mainly Ryelands.

On the farm given fourth place Montgomery red clover with a rather low yield and a small area of wheat with a very high yield of over 60 bushels per acre comprised the crops grown. The land was maintained in excellent heart, and a large area was used for carrying ewes for fat-lamb production. The returns from fat lambs, even though from three to five ewes per acre were grazed intensively, did not, however, allow of a sufficiently high interest rate on land valued at £35 per acre. The table on page 96 shows that the income from stock averages £3 per acre, whereas the income from crops averages £7 per acre. Had a few pigs been carried and a slightly larger proportion of the farm put in crop with the same high yield, this farm would probably have earned nearer to first place, because it was managed very economically. If household expenses had been included as a cost this farm would have ranked still higher, as returns from poultry more than paid the grocery account.

Much information was derived from the remaining farms. For example, the best returns from horses were obtained by P. V. Bailey; the highest cattle returns by J. C. Chamberlain; a useful method of saving expense and labour in the use of chaff-bags was shown by N. C. Powell, who built an endless belt for loading and tipping bags into the bins as they come off the chaff-cutter. Mr. Powell secured most points for buildings and plant. Mr. John Brooks secured the highest total for general points.

Conclusion.

The weather was unfavourable to the securing of the highest return, and to this extent the results were disappointing to some of the competitors, and are not typical. The competition committee propose to continue the competition, awarding certificates for the farms securing

the best percentage in returns relative to profit and loss each year, and awarding cups as funds accumulate each third year, on the basis of points for general headings as well as profit and loss. If large entries are obtained, so that similar types of farms are compared, very helpful management data will be obtained.

FACIAL DERMATITIS IN SHEEP IN NEW ZEALAND.

A PHOTOSENSITIVITY OF UNPIGMENTED SKIN.

Dr. C. S. M. HOPKIRK, Officer in Charge, Veterinary Laboratory, Department of Agriculture, Wallaceville.

FACIAL dermatitis, facial eczema, bighead, and sunburn are names given to a condition of sheep where the exposed unpigmented skin of sheep and cattle reacts to light, becoming severely burned. Two types are known, one being fairly prevalent in the South Island along the alpine foothills and back tussock-country, while the other has been seen mainly in the North Island during excessive autumn flushes of feed following prolonged dry summer spells.

HISTORICAL.

An œdema of the skin of sheep and the white areas of cattle has been known for a considerable time in connection with ingestion of St. John's wort (*Hypericum perforatum*), buckwheat (*Fagopyrum esculentum*), *Tribulus terrestris*, and certain medicagos and trefoils. Experimental trials, mainly in United States of America, Australia, and South Africa, showed the unpigmented skin only was subject to injury, there being elements in the plants mentioned which predisposed unpigmented skin to the harmful effect of ultra-violet rays. The injurious photosensitizing agent is a fluorescent body, and many fluorescent dyes and drugs have that action, examples being hæmatoporphyrin, quinine, eosin, rose Bengal, methylene blue, chlorophyll, phylloerythrin, &c.

While considerable work has been carried out in other countries on the photosensitivity due to St. John's wort the most valuable work on the whole question seems to be that performed in South Africa in connection with the disease "Geeldikkop," caused by ingestion of the plant Tribulus. In this work sheep with biliary fistulæ were used and the bile was obtained after feeding of the experimental plant. In Tribulus-feeding two factors have been found to work in combination, the one, a liver-upsetting factor, referred to as the icterogenic factor, and the photosensitizing factor which results from a breakdown of the chlorophyll-content of the plant.

In New Zealand facial dermatitis or facial eczema resembled in all its external symptoms "Geeldikkop" of South Africa. It is associated with a fast growth of pasture in the autumn following a condition of drought. The autumn of 1910, 1925, and 1926 were all of that description, and large numbers of sheep and some cattle became affected. On those occasions the condition was apparently not recognized as a photosensitivity.

A condition of scabby mouth due to a virus infection must not be confused with photosensitivity. In the former the ears are rarely, if ever, affected.

Recent Outbreaks.

Of the two conditions, that in the South Island is suspected to result from ingestion of a species of Hypericum or St. John's wort. Several species of Hypericum have been found around lagoons and near damp areas on stations in the affected areas by Dr. H. H. Allan, Systematic Botanist to the Plant Research Station, and experimental work is centred round the plant at present. Owing to the courtesy of Mr. T. D. Burnett, M.P., and owner of Mount Cook Station in the Mackenzie Country, 560 acres of an affected block have recently been set aside and stocked with merinos especially to elucidate the problem in that area. Also, plants have been gathered for experimental feeding of stock at Wallaceville.

In the South the position has not been as serious as in the North, for if sheep were kept off affected blocks during December, January, and February very few cases of dermatitis occurred. Further, there have been no bad after-effects as in the photosensitivity of the North Island, for livers are in no way damaged. The North Island outbreaks have, however, always been of a serious nature. The outbreak of photosensitivity in the autumn of 1935 was very wide in its distribution, most areas being affected except for Hawke's Bay and the Wairarapa, where very few cases were seen. Cattle are noticeably affected in the Waikato and Bay of Plenty. As a rule, high hill-country was fairly safe, only comparatively few affected lambs and sheep being seen. Rich flats were particularly dangerous.

In the Gisborne area observations were made after the initial outbreak of the trouble. There were no premonitory signs, and many thousands of sheep became affected in the same week. The same applied broadly to other areas. Rainfall in the Poverty Bay district during the summer had been so short that the pasture of the whole coastal area was dried up and in most places eaten out by sheep and cattle. Inland on the back, high hill-country precipitation was sufficient to keep the grass green, though it remained short. On such pastures no photosensitivity occurred. Rain commenced to fall round Gisborne on 7th February and the weather remained warm, overcast, wet, and dull for some weeks thereafter. Actual sunshine was intermittent and of short duration for that season of the year. As a result of the rainfall and warmth there was a fast-growing flush of pasture, but, contrary to expectation, it is said that scouring in sheep and lambs was noticeably absent. Œdema of the head occurred first on 21st February, and many cases in the district were reported by 25th February. Several owners of rich flat land were heavy losers, one man having at least five hundred sheep and lambs affected, while hill-station owners may have noticed twenty to fifty animals affected. Ram and ewe lambs and all older sheep irrespective of sex were alike affected. True, black-faced sheep such as Suffolks were not affected, but Romneys and Southdowns were very susceptible.

Pastures on the flat contained clovers, trefoils, and the usual grasses such as rye-grass, crested dogstail, ratstail, cocksfoot, &c., and ordinary weeds. No plants which one could suspect of causing photosensitivity

were to be seen except burr clover, which grows well on the Gisborne Flats and is considered suspicious. However, burr clover is not common in other parts of the country where facial dermatitis was seen.

The sheep-owners of the district stated that the paddocks had been well eaten out by cattle during the dry weather. The rain brought a quick flush of feed which cattle were not able to control successfully, and which perforce had to be given to sheep of all classes. Where cattle had been able to control the feed very little or no œdema developed in sheep. Photosensitivity developed in some cases in two days after sheep were placed on luscious pastures, but usually it took a little longer for trouble to develop.

An interesting point was mentioned in the district: that sheep, and particularly lambs, had not fattened as well in the dry weather as is usually the case. This was borne out in meat-works figures, for weights were considerably less in the lambs being put through for the fat-lamb trade.

Ante-mortem Appearance.

The first suggestion of photosensitivity was a shaking of the head and general restlessness. The ears quickly became œdematous and drooped, this being followed by a puffing of the eyelids, face, tongue, lips, and submaxillary space, and even, in some cases, the legs. In those sheep in which the wool was inclined to be open along the back, the skin of the back swelled, thus ruining the pelt. The temperature rose to as high as 107° F. Sheep actively sought shade and disliked being driven out into brighter light. Irritation of the skin caused the sheep to rub the skin of the ears, eyes, and lips on fences, ground, &c., which caused severe abrasion with subsequent infection and scab-formation. Ophthalmia developed and ulceration of the cornea was not uncommon from injury, while nostrils were frequently almost entirely blocked by scabs and catarrh. All mucosæ showed an icteric condition ranging from light, muddy colour to a deep yellow. Urine was dark and frothy. Black pigmented areas of skin remained normal. Sheep unable to obtain shade either travelled round the fence-line in an endeavour to break through, or they banded together with heads hidden beneath the bellies of other sheep. Sensitivity to all light was most marked, rest being obtained by affected animals only in dark sheds. When shade was unobtainable the skin-injury was intense and abrasion became so severe that it was necessary to slaughter the animal to put it out of pain. If sheep were placed in wool-sheds at the first indication of irritation, then face-lesions quickly recovered.

Post-mortem Appearance.

Incision in the abrased areas, whether head, back, or legs, showed an intense œdema of the subcutaneous tissue. The fluid was straw-coloured or even more deeply pigmented. Lungs, heart, spleen, alimentary canal, and kidneys were all normal, though there was some œdema to be noted in the pelvic fat of the kidney. Blood clotted normally, but the serum was extremely yellow. Urine was dark but not port-coloured, as in co-called "enzootic icterus."

The liver was the chief seat of damage. In all cases damage ranged from simple cholangeitis (inflammation of bile-ducts) to a state of deeply bile-stained necrosis of liver-cells. In acute cases of the disease the

liver was yellow-ochre coloured. The liver showed in many cases a mottling of the surface, the lighter areas appearing to follow the course of certain veins. The gall bladder was distended with a dark-green bile, and lymph channels leading from the liver contained a greenish lymph. The most interesting point to be seen in all livers was the thickening of the main bile-ducts leading from the lobes, particularly the left lobe. In normal sheep the bile-ducts are difficult to pick up, but in sheep with dermatitis this thickening was marked and the duct stood out as a white cord very similar to chronic infestation with liver fluke. The duct was found to be partially blocked with a brown, amorphous, inspissated mass of debris. Where the cholangeitis was of some standing the liver was hard and cirrhotic. With the partial damming back of bile, jaundice occurred and bile stained the body tissues as well as the liver-cells. Toxic changes in the liver, shown by mottling, probably occurred as a result of the inability of damaged liver-cells to deal with toxic products brought in the blood-stream from the alimentary canal. The main bile-duct to the duodenum was at all times patent. Sections of liver examined under the microscope showed a very great increase in bile-capillaries. In some cases cirrhosis was commencing in the liver in the supporting connective tissue about the bile-capillaries, and in quite a number of cases cirrhosis was becoming of a perilobular type and gave promise of going further. There was no sign of hæmorrhagic areas in livers from animals suffering from photosensitivity such as would have been seen in acute ragwort poisoning.

Discussion.

Two facts of importance were evident in the initial survey of the disease, the one photosensitivity, the other liver-damage. Both required explanation. It would seem that photosensitivity developed only where there was liver-damage, but liver-damage did not necessarily produce photosensitivity. Liver-efficiency tests with rose Bengal showed definite damage in the liver of the living subject.

A special inquiry was therefore made into the state of sheep and lambs' livers in the Gisborne area. At the Kaiti Freezing-works many thousands of livers were observed, and whenever necessary the holding from which the sheep came, together with information concerning the sheep, was obtained. A large number of livers were being discarded for hardness and mottling. This state of affairs had commenced early in January and was quite unusual. Although only a percentage of sheep with affected livers were photosensitive, animals without liver-lesions were not affected. In one or two lines where all or practically all livers were normal, no cases of head œdema had been seen and such lines came from green hill-country. Although much thought has been given to it, the reason for liver-damage and the exact time at which livers became damaged, whether before or after the flush of grass, is unknown and is a matter for further research. Several theories suggest themselves, but they lack proof at present. Once the liver became damaged, however, the flush pasture could readily cause the photosensitivity. Much work has been carried out in South Africa on chlorophyll of plants, and it has been shown that the green colouring-matter is broken down in the rumen to form a fluorescent body—phylloerythrin—some of which is normally absorbed and excreted by the liver. With damming-back of bile into the blood-stream this coloured body makes the skin

sensitive to light. Dr. Margeurite Henrici, also working in South Africa, has shown that chlorophyll of plants alters considerably not only from dry to wet season, but also from day to day and hour to hour. It is high in the young green leaf, but low in the dried or wilted plant. Sunlight during the day decreases it, and resynthesis occurs during the night. On dull days, as Gisborne had, the chlorophyll-content remained on a high level. Everything was therefore in an optimum condition for photosensitivity to develop provided the livers were damaged.

After-effects.

A further important aspect of the photosensitivity of the North Island was the very serious after-effect. The livers were so badly damaged that sheep were slow in recovering their energy and condition. Many died within a few weeks, others lingered on and died later. Ewes failed to conceive, and lambing percentages amongst affected ewes were very low. If sheep fattened and were sent to the meat-works the livers were found to be extremely badly damaged. The left lobe was completely atrophied, while the remainder of the liver was bulbous from regeneration of liver-cells. So badly damaged was the liver that affected sheep could never be entirely normal. Livers appear somewhat similar to those caused by severe ragwort-poisoning, but fortunately the two conditions can be differentiated. The damage appeared to have originated from occlusion of bile-ducts and not from blockage of blood-vessels in the liver. At present as a working hypothesis one must assume that liver-cells were slightly damaged by poison absorbed from the bowel during the dry weather. They were further intensely damaged by the damming-back of bile through blockage of bile-ducts.

Preventive Measures.

Advice regarding prevention of liver-damage with our present knowledge is impossible, but probably if green feed were available during the dry summer it would help considerably. Such a supply of green feed, however, would be almost impossible for most farmers to obtain without irrigation. Control of feed when conditions were known to be conducive to photosensitivity would certainly assist. This was seen in several cases where owners had kept paddocks eaten down with cattle. Should climatic conditions recur within the next few years owners should at once close up the majority of paddocks and heavily stock a few to prevent excessive growth. As an alternative, and where possible, the mower could be kept going to level feed off. One other practice which was adopted successfully on one farm in the Manawatu was to put out hay-racks for sheep in a small paddock and keep the animals entirely on hay and water during the first flush. They can then be slowly broken in to green feed.

Treatment.

Stock must be watched carefully with a view to early mustering if swollen ears appear. Driving must be carried out slowly in the cool of the day. Affected sheep require to be placed in dark sheds at once and kept there, getting no green food for two or three days. They should be supplied with water and a light

feed of hay. Badly burned sheep should be slaughtered, for they never do well afterwards. All affected sheep should be given Epsom salts, Glauber salts, calomel, or other purgative to stimulate the bowel and liver. Faces may be treated with a black ointment or with Stockholm tar, so as to cover the skin with a black pigment to keep off light. Sheep kept in sheds should be first of all let out at night for a few hours grazing, then let out in the daytime, but with the shed left open so that if they still feel the sun they may return to the shed at will. Such convalescent sheep should not be returned to a flush of grass or they may readily suffer a relapse.

SUMMARY.

Facial dermatitis is known in both North and South Islands. In the South it is believed to be due to a plant probably a species of Hypericum, while in the North the condition occurs under definite climatic conditions.

Two factors operate in the latter case—the one liver-damage, the true cause of which is unknown; and the other, absorption of a fluorescent material from the breakdown of chlorophyll, which sensitizes the unpigmented skin to light. Prognosis is bad in such cases, alleviative treatment being to give purgatives and to keep in the dark away from sunlight until they have recovered.

LEMON-CURING FOR SMALL GROWERS.

W. K. DALLAS, Citriculturist.

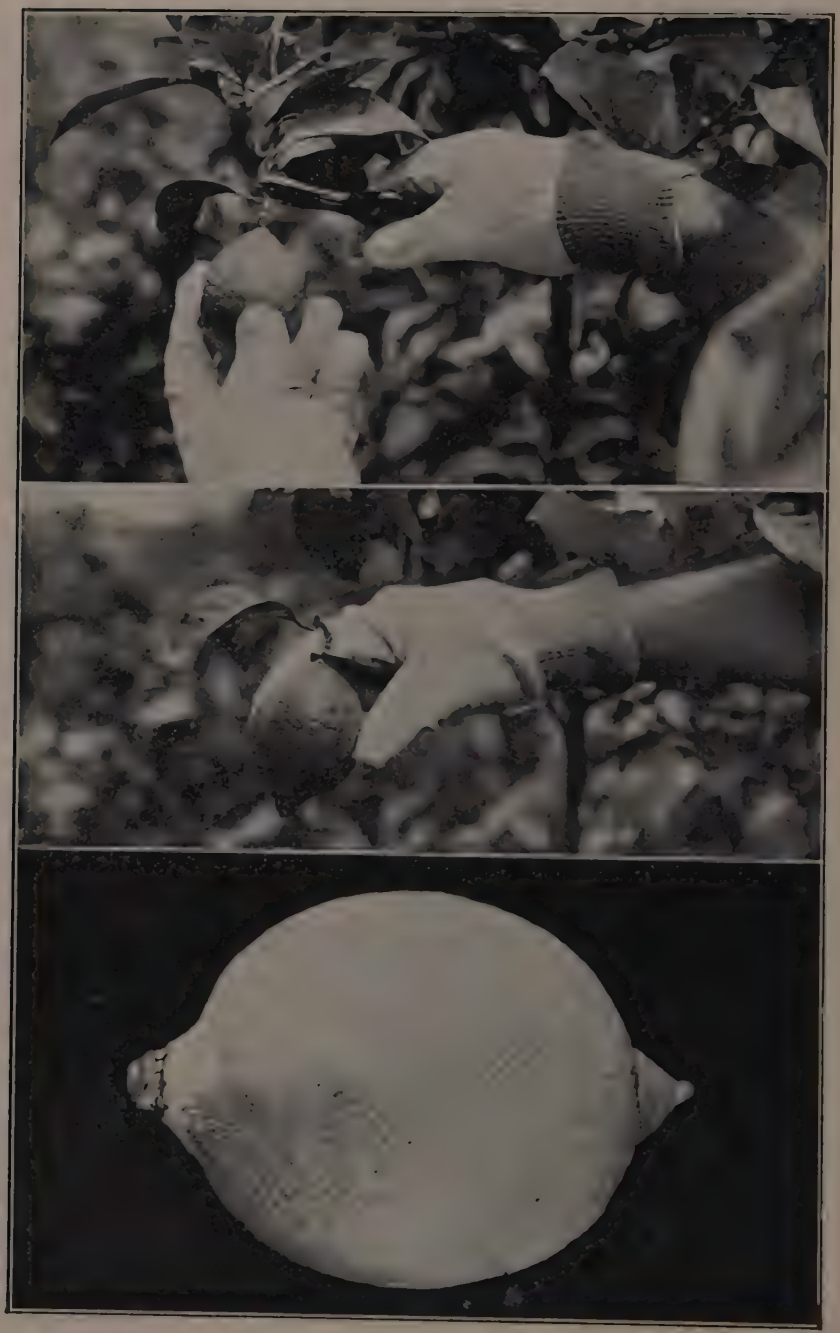
THESE notes have been prepared for the guidance of persons who have but a few lemon-trees growing on the property which they are occupying.

Lemons carefully handled and gathered from the tree at the right stage of maturity may be successfully cured or conditioned, and then stored for several months without deterioration. By suitable treatment their keeping and edible qualities and appearance are improved.

In the process of curing, lemons are submitted to a mild dehydration treatment, which causes the skin to become thinner and tougher. When properly cured the rind of the lemon should be smooth and soft, and the colour of the fruit changed from green to yellow.

To obtain the best results from curing, the lemons should be carefully cut from the tree, preferably with sharp clippers with rounded nose, when they have reached a size of approximately 2½ in. in diameter, but are still green or silver-green in colour. The stalk should be cut just beyond a mature bud and about 1½ in. from the fruit, then double-clipped level with the button, for unless this is done the protruding stem is liable to damage fruits with which it comes in contact. Every care should be taken to avoid scratching the lemons with the finger-nails or other means, and damaging the rind by bruising. Injured parts readily decay.

After picking, the fruit should be placed in trays or shallow boxes in a shaded, airy position and allowed to remain for several days to permit the excess moisture to exude from the rind. If not sweated in this way the lemons will tend to become unduly damp in storage and thus be more liable to infection by moulds.



PICKING LEMONS.

Top, first clipping; centre, second clipping; bottom, lemon correctly clipped.

The dipping of the lemons in water heated to 110° F., containing borax at the rate of 4 lb. to 5 gallons, for a period of four minutes, before placing them in storage, is practised and recommended to reduce the danger of the fruit becoming affected with blue or green moulds.

The fruit should then be put in a box with one-piece sides or in trays, covered with a piece of canvas or other suitable material to prevent excessive wilt of the fruit, and stored in a darkened room in which the relative humidity and temperature should not be allowed to fall too low. A relative humidity of about 75 per cent. and a temperature of between 40° and 65° F. is suitable. If the atmosphere of the storeroom is considered to be too dry, the humidity can be increased by sprinkling water on the floor as occasion demands. According to the temperature maintained, the curing process should be completed in from six to ten weeks. If it is desired to speed up the colouring, a higher temperature and humidity may be maintained about the fruit by covering the boxes entirely with canvas or sacks when it is placed in the store; or the temperature may be increased by the use of a paraffin or other heater. The fruit should be inspected periodically, and all lemons which show signs of decay carefully removed from the box and burnt.

Another method of curing the fruit is to store the lemons in clean, slightly damp sand or sawdust in one-piece-sided boxes lined with paper. A layer of about 2 in. deep of the material to be used is first laid down, and then a single layer of lemons is placed on this so that no two fruits are touching. The lemons are then covered with at least 1 in. of the material which is being used to store them, and then another layer of fruit, and so on, until the box is full.

Briefly, the recommendations are—

(1) Carefully clip the fruit from the trees when it has reached the size of $2\frac{1}{4}$ in. to $2\frac{1}{2}$ in. in diameter and while green or silver-green in appearance—green lemons keep longer than those ripened on the tree.

(2) Handle the fruit carefully to avoid causing injury to the skin of the fruit.

It is through injuries such as punctures, scratches, and bruises that rot fungi gain access to the tissues.

(3) Place fruit in shaded airy situation for four days to sweat.

(4) Then dip fruit for period of four minutes in borax solution (4 lb. borax to each 5 gallons water) heated to 110° F. and allow fruit to dry.

(5) Place fruit—

(*a*) In a close-sided box or box lined with paper or in trays and cover with canvas; or

(*b*) Between successive layers of slightly damp sand; or

(*c*) Between successive layers of slightly damp sawdust.

(6) Examine fruit fortnightly for purpose of removing mould-infected fruits, which should be burnt.

(7) Maintain as far as practicable a temperature of between 45° and 65° F., and a relative humidity of approximately 75°.

(8) Curing process will take from six to ten weeks, according to the conditions under which the lemons have been produced.

Green lemons usually take longer to condition than silver-green lemons.

(9) The storeroom should be darkened, kept well ventilated, and draughts should be avoided.

MANUKA-CONTROL IN OTAGO.

J. M. SMITH, Fields Superintendent, Department of Agriculture, Dunedin.

DURING recent years manuka has made serious inroads on to some of the better pastoral country of Otago, and at the present time the threatened invasion by this scrub of farming lands is serious. While manuka generally is looked on as a weed of poor land, like many other weeds, if given the opportunity, it rapidly spreads on to adjoining good land, and this is what is taking place. (Fig. 1.) The size of many holdings where manuka has a hold, together with the value of the land and the present financial returns for produce, means that some fairly cheap method of control must be practised to make such control economically sound. Undoubtedly the cutting of the scrub, prior to burning and sowing, is the most satisfactory way of dealing with manuka, but when the cutting alone will involve an expenditure of between £1 10s. and £3 an acre (dependent upon the denseness of the scrub) it will be seen immediately that the cost of this system over much of the pastoral land is prohibitive. It should be recognized clearly that there is much land in Otago of such a low standard of fertility, and at present in dense manuka, that it cannot profitably be brought back to a grazing state, but the treatment of such land by way of afforestation is beyond the scope of this paper. It will thus be seen that some cheap yet efficient method of burning the standing scrub, to be followed by the sowing of a cheap yet productive grass-mixture, must be the line of action to be followed. Promiscuous burning, which has been practised largely in the past, is not satisfactory, in that a fringe of green scrub on the outer area is left unburnt and the spread goes on unhindered. The prevention of the spread is actually of as much importance as the cleaning-up of the dense centre of the area. (Fig. 2.)

With a view to determining whether some cheap yet efficient method could be followed, a block of standing manuka where the scrub was some 8 ft. to 10 ft. in height was taken over on the property of Mr. R. S. Thompson, Wetherstones, Lawrence, in 1930. This block was divided into three areas of sufficient size to warrant the costs and results being of a practical nature. Area No. 1 was completely cut and subsequently burnt and sown. (Fig. 3.) Area No. 2 was fringed—*i.e.*, the scrub was cut round the block to a depth of 12 ft. and was subsequently burnt and sown. Area No. 3 was tracked—*i.e.*, every 20 yards a track 12 ft. wide was cut through the standing scrub. The cutting was done during the summer and the area was fired on 13th May. Very favourable conditions were experienced for burning, and the results on all blocks were exceptionally good.

As a result of this experimental work, together with the experience of settlers who are handling the problem efficiently, and, it would seem, economically, it is felt that the following system, with variations to suit local conditions or certain seasons, should prove satisfactory.

The manuka should be burnt standing after having been fringed to a depth of several yards. This fringing should consist of slashing all scattered bushes on the outside ring of the standing block, together with a reasonable belt of the standing manuka. Solid manuka can be burnt without fringing, but as a rule such a burn leaves a ring of standing scrub

round the burn, and this ring continues seeding and so causes new infestations of seed each season. Fringing also allows the commencement of a fierce fire, which carries on with vigour through the standing scrub. The actual time of burning depends largely upon local conditions, but

FIG. 1, SHOWING THE GRADUAL SPREAD OF MANUKA ON GOOD GRAZING COUNTRY.

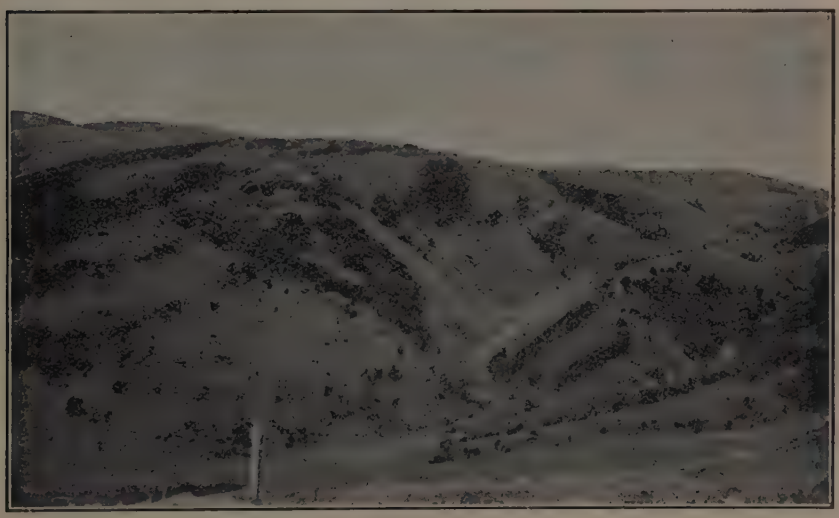


FIG. 2. THE RESULT OF INDISCRIMINATE BURNING, SHOWING THE GREEN FRINGES UNAFFECTED BY FIRE.

burning should be carried out at a time when the best burn can be obtained and when the chances of a good strike of grass are best. It should be emphasized, however, that there may be only one or two opportunities to get a first-class burn each season, and these opportunities

should be waited for. A good hot burn, when the vegetation beneath the standing scrub is dry right to the ground, results in a complete kill of the standing scrub, the preparation of an excellent seed-bed in the ash, and the destruction of much seed both on the ground and on the manuka itself. In tussock country the weight of evidence is in favour of spring burning of manuka.

It is considered by some to be an advantage to cut belts through the standing scrub, as such procedure ensures a better burn by livening up the fire at 20 yard intervals, facilitates sowing ; and enables stock to move more freely over the burn subsequently. The cutting of such belts, however, greatly increases the cost, and unless the benefits are likely to be extensive this procedure can hardly be deemed necessary or economical. In the experiment under review the tracking was of no advantage.

FIG. 3. AREA NO. 1, ON LEFT, ALL SCRUB CUT; AREA NO. 2, ON RIGHT, FRINGED.
To be noted almost entire absence of second growth on area No. 1 ; area No. 2 fenced to allow of growth to carry secondary burn.

The surface-sowing of a suitable seed-mixture immediately after the ash has cooled is strongly recommended. In some few cases there may be sufficient brown-top and danthonia present prior to burning to warrant the elimination of any sowing, but if the standing manuka has been there for any length of time it is hardly likely that there is sufficient grass present to carry on. There may be a certain number of suitable plants present, however, in which case the sowing could be at a less rate than where the ground is devoid of any pasture plants. Local conditions undoubtedly should be a guide in connection with the grass-mixture to sow, but in general brown-top and danthonia should be the main species. This surface-sowing is likely to constitute the main cost in connection with this method of manuka-control, and consequently requires to be closely watched. Its total neglect, however, must be avoided, for without the application of seed, where the area is devoid of pasture plants, only such growth as bidi-bidi, &c., will follow the burn, and as far as productive value is concerned the area might as well

be still in scrub. For general purposes the following mixture, expressed in pounds to the acre, might be adopted: Brown-top, 6; *Danthonia pilosa*, 4; crested dogstail, 3; Chewings fescue, 2; *Lotus major*, 1; white clover, 2.

FIG. 4. SHOWING AREA FENCED AND UNGRAZED PRIOR TO THE SECONDARY BURN.
The growth is principally manuka, but with sufficient brown-top, &c., through it to ensure a fierce "carrying" fire once the brown-top, &c., has dried.

Perennial rye-grass and cocksfoot might be included in a special mixture for better-class land and for gully-bottoms, but for general application their inclusion can hardly be recommended. This phase, however, leaves much room for experimental work. The main feature

of the mixture is the brown-top-danthonia-lotus association, which association will stand up to, and probably improve, under subsequent burnings which will undoubtedly be necessary.

If the original burn was a good one and the strike of grass satisfactory it will probably be several years before there will be any second growth to worry about. When this growth does appear it will be necessary to deal with this by a secondary burn. To carry a satisfactory fire at this stage it is obvious that there must exist a fair quantity of dry roughage, and this will only be secured by spelling. (Fig. 4.) Possibly, however, sufficient roughage will be secured by the falling sticks making hard grazing impossible. After four or five years the standing burnt manuka begins to collapse, and this may form a protective covering by which hard grazing of the pasture by stock is prevented, and in the spring of the year a fire of sufficient fierceness may be obtained to deal with the second growth. On the other hand, it may be necessary (and probably would prove most beneficial in the end) to spell the area for a season to secure this roughage to carry the fire. This would entail the fencing of the area into blocks that can be conveniently spared for a complete season. Naturally this would increase the cost somewhat, but unless this can be done, and the second growth thus dealt with, it is feared that the area may rapidly revert to its original manuka position. No further seeding should be necessary following this second fire, although it may offer an opportunity to sow seed on patches and thus build up any weak spots.

The whole of the handling of this country hinges round the cost, for if the cost is too great it becomes beyond the means of the average settler, and it is impossible to get anything done. To arrive at actual costs is extremely difficult. To begin with, the area to be fringed per acre depends upon the density of the manuka and the area over which a dense block occurs. For instance, if the blocks are small the fringing per acre is larger than where the blocks are large. For the actual area fringed the cost is probably about £2 per acre, and if it is necessary to fringe 1 acre in ten this brings the cost to 4s. per acre of the block to be treated. In many cases with big blocks the cost should not be more than 1s. to 2s. per acre. The cost of the grass-seed mixture also varies, but the cost of the mixture quoted, at current rates, is about 30s. per acre. To this must be added any fencing-costs that are incurred, together with the clearing of the fence-lines prior to the second burn.

Summary.

(1) Much of the grazing country of Otago can be economically held, and even brought back, from manuka invasion.

(2) Complete cutting, burning, and sowing, while giving the best results, probably proves too costly in most instances.

(3) Fringing to a depth of several yards, and burning at an opportune period, to be followed by the sowing of a suitable grass-mixture will prove satisfactory, provided

(4) That this is followed by spelling to allow satisfactory secondary burns.

Acknowledgment is made to various Fields Division officers, past and present, who were responsible for the experiment on manuka-control, and to Mr. R. S. Thompson, Lawrence, for his co-operation.

PARASITIC GASTRO-ENTERITIS OF LAMBS AND HOGGETS.

WARNING TO FARMERS.

C. S. M. HOPKIRK, Veterinary Laboratory, Department of Agriculture, Wallaceville.

THE present season, with its excessive growth of grass, abnormal rainfall and warmth, is an excellent one for parasitic infestation of young sheep. Throughout the country lambs are not, as a general rule, thriving because of the coarse feed conditions, and such lambs readily become infested with stomach and intestinal worms.

It is therefore advisable for farmers to commence the control of parasites at once. This is best done—

(1) By quick changes of lambs every few days on to fresh pasture :
(2) By thorough eating-down with cattle of those paddocks best suited to lambs before changing lambs to them :
(3) By periodic drenching of lambs.

All three methods should be employed in order to combat parasites successfully, but the third method is most essential.

Recently a very useful parasitic drench based on a knowledge of physiology of the sheep has been advocated in other countries and has been given a trial at the Veterinary Laboratory, Wallaceville, on lambs and two-tooths. Results in two-tooths have been exceptionally good. The drench consists of 1 lb. bluestone dissolved in 5 gallons of water, and, after the bluestone is thoroughly dissolved, a 1 lb. tin of Black Leaf 40 is added.

Drenching at ten to fourteen day intervals of all young sheep and lambs should be kept up from now till the danger period has been passed. Dosage is ½ oz. to lambs and 1 oz. to young sheep.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 12th December, 1935, to 31st December, 1935, include the following of agricultural interest :—

No. 72911 : Manure-distributor ; E. C. Houchen. No. 73276 : Production of milk-powder ; J. B. M. Knutsen. No. 73471 : Preparing whey concentrates ; Kraft-Phenix Cheese Corporation. No. 73478 : Tool for ring-barking trees ; Commissioner of Forest Lands. No. 73649 : Sheep-shearing machine ; Cooper Engineering Co., Ltd. No. 73736 : Manure-distributor ; E. V. Twose. No. 74502 : Preserving fruit ; T. A. Robertson. No. 74557 : Drying timber ; W. E. Saunders. No. 73112 : Separator ; Ramesohl and Schmidt. No. 73220 : Ringing animals ; R. Du Pontet. No. 73744 : Cream-cooler ; A. M. Campbell. No. 73859 : Gate-latch ; J. Johns. No. 74089 : Plough ; T. and W. G. Yardley. No. 74216 : Curing cheese ; the A. A. Ayer Co., Ltd. No. 74342 : Removing wool from skin ; I. W. Archibald. No. 74555 : Feed-trough ; D. F. J. Hopkins. No. 74577 : Eradication of lung-worm ; C. B. Bazley. No. 74628 ; Shearing hides ; M. M. and A. van Osselaer. No. 74662 : Egg-grading ; Kraft Egg Machine Co. No. 74722 : Sheep-drenching device ; Hart and Co. Pty., Ltd. No. 74781 : Harrow ; J. H. Gibbs. No. 74840 : Branding-device ; R. E. Starr, M. J. Plomley, and E. F. Plomley. No. 74913 : Fencing-standard socket ; P. C. Scott. No. 74974 : Horse-shoe ; A. G. Craft. No. 75003 : Barbed wire ; H. A. Abbott.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

SEASONAL NOTES.

THE FARM.

Pasture Establishment.

EXCEPT in districts subject to relatively early heavy frosts, autumn sowing of seed for the establishment of permanent pastures rightly is much followed as the result of field experience. Generally March sowing gives best results, because frequently in March the soil possesses both the warmth and the moisture which beget the rapid and strong establishment of seedlings. If the sowing is deferred until late autumn or early winter there develops much likelihood of poor establishment, particularly of clovers—indeed a substantial proportion of the indifferent results that come under notice are due primarily to too late sowing at this season. In occasional favourable seasons or circumstances sowings that would be too late under ordinary conditions are attended with success. These are remembered, whereas the more numerous instances of failures following too late sowing are overlooked. Indeed, it seems likely that many cases of unsatisfactory results due to too late sowing are attributed to other causes; for instance the owner seldom assigns late sowing as the cause of unthrifty young pastures —he is more inclined to attach the blame to such a cause as poor seed— but actually many of the unthrifty young pastures that are noted originate in poor "strikes" of the clovers which in their turn arise from unduly late sowing. It is of practical moment that the rye-grasses and red clovers, generally speaking, establish satisfactorily at lower temperatures than other species commonly used and so safely can be sown later in the autumn or earlier in the spring. On the other hand, white clover, cocksfoot, and timothy require for successful establishment more favourable conditions than rye-grass and red clover. Hence a sowing which may seem successful in its early stages because of the appearance of the rye-grass and red clover may eventually prove unsatisfactory because the expected development of white clover, cocksfoot, &c., does not take place. Further, most species, if sown too late in the year, although germinating, do not establish to the best advantage before the advent of winter because of the initial stunting and probably never develop into as robust plants as would have been produced had growth been vigorous from the outset.

Although satisfactory results have been obtained widely from surface sowing it is desirable when practicable to cover all seeds to minimize the effect of dry conditions immediately following conditions which have brought about germination. The general aim of covering practices should be to cover such seeds as rye-grasses, cocksfoot, and clovers to depths of about $\frac{1}{2}$ in. and not to greater depths than about 1 in., and finer seeds generally to less depths. In soils containing large and coarse lumps proper covering is impossible, while on the other hand too fine and powdery a condition of the soil hinders proper covering; successful "strikes" commonly are obtained when the surface is slightly rough, as is the case when it is composed largely of lumps of from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. in diameter.

The necessity of a good tilth and firmness of the seed-bed which has been dealt with in these notes during recent months can scarcely be overemphasized. The desirable degree of firmness which is obtained most satisfactorily and economically as the result of adequate preparatory cultivation greatly assists in bringing about an even sowing and is specially necessary to ensure that seeds start well into growth. When the seed-bed is sufficiently fine and firm pasture seeds usually may be covered effectively by a stroke of the tine harrows. If the seed-bed is loose and dry, the use of

the Cambridge roller after sowing is usually advisable; but if there is probability of heavy downpours of rain it is frequently well to finish with the harrows instead of the roller, especially when the soil contains an appreciable amount of fine silt which readily leads to the formation of caked soil-surfaces after beating rains. The sowing of other crops such as oats with pasture seed is sometimes favoured because of the belief that the companion crop will protect the pasture seedlings. Such crops, which are called cover or nurse crops, generally are of little or no value as protection and readily may cause injury by depriving the pasture seedlings of direct sunlight and also possibly of adequate moisture. Such injury may be minimized if the companion crop is sown thinly and not allowed to mature, but even under such circumstances the possibility of injurious shading is not eliminated completely, and hence the use of companion crops generally is not recommended. Exceptional cases which warrant the use of cover crops may arise in exposed situations, and in such cases barley or white oats may suitably be used—usually Algerian oats are not suitable because of their relatively slow growth in the early stages, when shelter might be needed by the pasture seedlings.

The Composition of Seed-mixtures.

A primary objective in grass-farming is to obtain the most even possible supply of feed from season to season throughout the year. At the same time uniformity in the amount of feed available from one season to the other must not be secured at too great a sacrifice in the total yield of feed. A fundamental matter in framing pasture seed-mixtures fitted to give the greatest possible evenness in the seasonal supply of feed is the well-known fact that different pasture-species in their growths respond differently to particular conditions. For instance, rye-grass and dogstail and No. 1 white clover grow more freely than cocksfoot, timothy, and Montgomery red clover early in the season; in most of the milder parts of the North Island paspalum is active in mid-summer and practically dormant in winter, while subterranean clover tends to be dormant while paspalum is most active and most active when paspalum is least active in growth.

A moot question is how should this knowledge of the different growth-behaviour of different species be used. Clearly, by including in the pastures on a farm a series of species such as rye-grass, white clover, cocksfoot, and red clover, it is possible to obtain a more even supply of feed throughout the year than would result from the use of fewer species. The question of practical moment is whether the species should all be sown together so that each pasture becomes a mixture of considerable amounts of all the species or whether different species should not be dominant in different fields throughout the farm so that for practical purposes there is a range of species on the farm as a whole rather than on each field of pasture on the farm. This question was discussed at some length in these notes in February, 1935, where it was stated that "Investigations and field experience both in New Zealand and overseas suggest the advisability of employing more freely still more simple mixtures designed to cater especially for a particular season and also usually to fill a particular need." This view is quoted because in the interval further evidence has accumulated in support of it. An outstanding instance of the successful application of this conception is provided in the numerous pastures, in which subterranean clover is dominant, which are dotted throughout the North Island at least. Similarly, in the warmer districts, marked success has attended pastures in which paspalum is dominant in the summer. There seems every reason to expect that similar success would be associated with other special pastures. For instance, a special pasture with cocksfoot and Montgomery red clover as its dominant constituents contains, under lenient spring grazing, promise of a better supply of feed late in the season

than would result were the cocksfoot and Montgomery red clover used on several fields subject to normal grazing and containing the customary proportions of other pasture species.

Under the methods of grazing which to-day are widely carried out certain valuable plants often are not employed to the fullest advantage. The needs of cocksfoot and rye-grass well illustrate this: under moderate to high fertility, if the grazing is relatively severe and continuous, perennial rye-grass readily outyields cocksfoot, whereas under the same type of fertility, if the grazing is sufficiently lenient, cocksfoot outyields the rye-grass. Further, as a rule, plants defoliated at the critical stage of early active growth suffer more severely than plants similarly defoliated when beyond the critical stage of early growth. Hence, when rye-grass and cocksfoot both are important constituents of a sward, considerable difficulty arises in the planning of grazing which will utilize the rye-grass in the best manner and at the same time avoid injurious defoliation of the cocksfoot which is likely to be at the critical stage of early growth when the rye-grass is already beyond that stage.

The use of special pastures at times would allow both plants to be utilized with greater effect. By having a sward in which rye-grass is dominant and another in which cocksfoot is dominant it would be possible to adapt the time and manner of grazing each sward to its specific needs and so to avoid any weakening of pasture plants by unsuitable grazing. Hence special pastures properly used should mean not only a more even supply of feed throughout the year, but also an increased supply of feed. From the above statements it follows that a basic aim of special pastures is to associate as dominant constituents species each of which may be used effectively without any injurious influence upon the others. This may be done in one of two contrasting ways. Firstly, it may be done by associating plants which coincide in their season of growth; these plants can be kept strong by being allowed to go unchecked by defoliation at the critical time of early active growth. Suitable companion plants for this purpose are cocksfoot and red clover. Secondly, it may be done by associating plants which contrast in their season of growth so that one is naturally dormant when the other is most active. The splendid results obtained in milder districts by growing together paspalum and subterranean clover illustrate this and are due to the fact that the plants do not interfere with each other in their growth.

The alternative to seed-mixtures designed to give special pastures of the types just discussed is to use seed-mixtures of the kind which have been used extensively in recent years with relatively good results. These mixtures are designed to give general-purpose pastures, and the nature of their constitution is indicated by the following mixtures which have been used successfully (all amounts being per acre):—

For permanent pastures a mixture which is suitable for use over wide areas in both North and South Islands: True perennial rye-grass, 20 lb. to 25 lb.; New Zealand cocksfoot, 10 lb. to 15 lb.; crested dogstail, 3 lb.; timothy, 3 lb.; New Zealand white clover, 2 lb.; red clover, 3 lb.

The smaller amount of rye-grass in this mixture is advisable when the summer rainfall is below that needed for good results with rye-grass, as under typical Canterbury and similar conditions; and under these conditions the larger amount of cocksfoot is advisable, as it also is when it would not be profitable to raise the fertility of the land up to rye-grass-fertility requirements by top-dressing.

The following modifications to the mixture are likely to be advisable under the conditions specified:—

(1) On land which is of naturally high fertility and on which the permanence and good growth of rye-grass all the year round is assured, a mixture consisting of 40 lb. of perennial rye-grass and 3 lb. of white clover may be used, the other species being omitted. There is only a limited area of such land.

(2) In many northern districts of the North Island paspalum at the rate of 6 lb. to 8 lb. an acre may advantageously replace cocksfoot.

(3) *Poa trivialis* at the rate of 2 lb. an acre should be included on high-class country which is damp in the winter.

(4) Meadow foxtail is a grass of high value on fertile swamps too wet in winter for success with rye-grass, and 6 lb. an acre should be included for such conditions. But if it is at all practicable to drain the land and thereby make it suitable for rye-grass, this should be done and rye-grass sown.

(5) Strawberry clover at the rate of 1 lb. an acre may well be substituted for white clover on land too wet for the latter, and its use is also advisable for salty marshy conditions.

For temporary pastures of one or two years' duration a mixture which may be expected to give good results widely is: Italian rye-grass, 25 lb. to 30 lb.; red clover 6 lb.: total, 31 lb. to 36 lb. per acre. The temporary pastures that such a mixture would provide are of considerable value both as a means of spelling land which has been impoverished by cultivation and as a means of weakening or eliminating weeds, such as blackberry or tall fescue, prior to the sowing of a permanent pasture.

For short rotation pastures which are intended to have a life of two to three years the mixture recommended is as follows: Italian rye-grass, 15 lb.; perennial rye-grass, 15 lb.; red clover, 4 lb.; white clover, 2 lb.: total, 36 lb. per acre. Short-rotation pastures are employed mainly on farms on which—largely because of climatic conditions—arable crops instead of pastures are the dominant feature.

Detailed information about seed-mixtures for specific purposes and conditions is available from local officers of the Fields Division.

Two points about seed-mixtures which are of general moment are:—

(1) Since the introduction of seed certification several years ago each year has provided additional conclusive evidence that the use of certified seed is economically well worth while. It is now widely recognized that certified perennial rye-grass should be used whenever the use of perennial rye-grass is warranted. Probably a fact not so widely recognized is that the great difference between good and poor strains of perennial rye-grass is paralleled by the difference between good and bad strains of white clover.

(2) All lines of seed, including certified seed, should be purchased on the basis of their value, which is determined to a substantial extent by the germination-capacity. The appearance of seed is far from a reliable indication of its germination-capacity.

Management of Established Pastures.

The valuable role of top-dressing at this season as a means of bringing about increased production of leafy feed was discussed in these notes last month. Of the several measures which may be employed to increase the supply of leafy feed which is apt to be in unduly scant supply, top-dressing, especially with phosphates and, in suitable districts, basic slag, deserves pride of place. Another practice which assists in bringing about leafiness in pastures is "topping," which consists not of close mowing, but of light mowing which removes the flower-heads.

Grass-harrowing as soon as good rains occur is another practice which at this season fosters production of leafy feed on pastures on which droppings have accumulated during the usual dry summer spell. The main objective, which is the distribution of droppings, is achieved most effectively by two strokes of the harrows, one at right angles to the other.

Work with Special Crops.

The sowing of catch crops in late summer is at times well worth consideration. Land having grown such crops as oats, wheat, maize, millet, or soft turnips may be ploughed immediately these crops are removed and

then sown without delay in temporary pasture (for which a seed-mixture has been given in a preceding paragraph) or oats or barley. Black skinless barley, at the rate of about 2½ bushels an acre, may be sown for earliest possible use. Algerian oats are useful for providing later feed. With all these crops it is generally profitable to apply, at the time of sowing, superphosphate at the rate of 1 cwt. to 3 cwt. an acre according to the natural fertility of the land. In preparing the land for catch crops it is not necessary to reduce the surface soil to a fine condition; indeed, the presence of fine clods at times proves a distinct advantage. The clods eliminate the caking of the surface, which may develop in a fine surface layer of soil under beating rain, and eventually they are broken up by natural weathering. If the land to be sown in such crops is so hard as to make satisfactory skim-ploughing impracticable, then cultivation with disks set with plenty of cut frequently serves suitably as an alternative to the skim-ploughing. Such crops, and particularly the temporary pasture, should be sown with as little delay as possible. These crops serve not only for sheep and cattle, but also particularly well for pigs provided they are consumed by the pigs when in a leafy stage They become available for pigs when the amount of feed available from the pastures is undesirably scant. Grazing pigs for full success require an abundance of leafy feed.

Ultilization of Crops.

At times maize and millet grown for green feed are kept too late. Frequently, rather than take the risk of having them become woody or of having them cut down by frost, it is advisable to utilize them earlier and to employ the land thereby rendered vacant in growing one of the catch crops mentioned. As a rule, any portion of the maize or millet not required for green feed can be conserved as silage.

Lucerne and red clover also at times are allowed to become too woody at this season. Usually at this season the qualities vitally needed in crops are high digestibility, high mineral content, and high content of protein required for milk and flesh formation. In all these qualities there is a falling-off in green feed as it approaches maturity which is associated with woodiness.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Export of Fruit.

When these notes appear the handling of the export fruit crop will have commenced in earnest, and a few reminders may perhaps not be out of place.

The benefits to be derived from making several select pickings have been mentioned in previous notes. It is advisable to obtain the advice of the local Orchard Instructor before commencing to pick a variety. It is a mistake to pick fruit too early before it is sufficiently mature. The first picking should be a light one, and only fruits of suitable maturity should be harvested. As the season for the respective varieties advances the problem becomes one of picking the fruit before it becomes over-mature, and growers and pickers should watch this carefully, particularly while waiting to secure increased colour on the fruit.

Bruising may be caused by careless emptying of picking-bags, by over-filling of orchard cases, by rough handling, by dirt and grit on the mechanical grader and in the packing bins, by too high a pack, &c. No effort should be spared to eliminate such causes of injury where they exist.

When lines of fruit of low colour or of fruit more than slightly russetted are being graded, a frequent examination of the fruit when it has reached the packing-bins is desirable. By this means any tendency to fall below the standard in grading can be checked and corrected immediately.

There should be no need to emphasize the necessity for maintaining the standard grades set for fruit intended for export. A careful perusal of the grading standards set out in the export regulations is of value in avoiding misunderstandings and delays during the season.

The practice of "flag-wrapping" the fruit which is indulged in by some packers should be discontinued. It is not only slovenly, but to an extent defeats the main objects in wrapping the fruit. As the case is being packed the layers should be consolidated. The completed pack should be firm, and should have the requisite bulge. In completing the case the lidding should be done without bruising and the wire should be applied neatly and tightly. The stamping of the label should be done neatly and clearly, for too frequently the stamping is indistinct and in consequence fades altogether before the case arrives at its destination. To complete the good effect desired the particulars should be stamped parallel to or in alignment with other printed particulars upon the label.

It is advisable to use only new, bright, clean cases. Weathered and dirty cases should be discarded. A neat and tidy package creates the first favourable impression upon the buyer.

Local-market Fruit.

Too frequently with the exporter the local market is looked upon as a handy outlet for all his export rejects. In the rush usually associated with export the rejected fruit, including much of that which is immature, is hastily packed and forwarded to the local markets in the hope that it will bring a payable price. The fruit, besides being immature, often is packed poorly or indifferently in soiled, untidy-looking cases, and carelessly branded. It is because of this that disappointment with the poor prices realized for the fruit is often experienced.

This position may be met by permitting a larger proportion of the fruit carrying excess russet or too little colour for export to remain on the trees to tree-ripen. Such fruit is much more acceptable to the public. Varieties not intended for export should be allowed to reach a more forward stage of maturity before being harvested.

All diseased and useless fruit should be gathered and destroyed or deeply buried. Orchard hygiene is of great importance in lessening the carry-over of disease, and should not be overlooked in the general rush of work.

General.

In the orchard the general work now in the main consists of applying sprays to the later-maturing varieties, and these should be continued, especially upon susceptible varieties, for the control of leaf-roller caterpillar and black spot.

Tree-supports requiring adjustment should be attended to, and, where necessary, further support given to the limbs of the laden trees to obviate fractures and splitting at the crotch.

—R. G. Hamilton, Orchard Instructor, Hamilton.

Citrus Culture.

All citrus trees should benefit materially from the rains experienced during the month of January. An effort should be made to keep the surface well cultivated to prevent the excessive loss of moisture from the soil in the event of a dry spell being experienced. Wherever it is possible the mulching of the soil about the trees with dry litter not only assists in preventing the growth of weeds, but also affords protection against undue evaporation.

In harvesting the summer crop of lemons an endeavour should be made not to allow the fruit to become too large, but to pick it when it has reached from $2\frac{1}{4}$ in. to $2\frac{1}{2}$ in. in size.

By the autumn the majority of the young growth will have hardened. In groves where it is still necessary to do a small amount of pinching and spacing of the shoots this should be done without further delay to give the new growth which develops as a result of this treatment every chance of becoming reasonably hard to be able to better withstand frosts that may come along later in the season. At the same time, as far as is practicable, old and worn-out portions of branches should be cut out.

The fertilizers applied at this period should not contain matter of a highly nitrogenous nature, but in the main should consist of phosphates and potash. A fertilizer, such as blood and bone, which becomes slowly available is preferable to sulphate of ammonia, as it does not force excessive wood-growth before the spring, and therefore can be used with safety.

Trees affected with red-scale should be sprayed while the scales are in the young unprotected or "crawler" stage with summer oil, 1 part oil by volume to from 33 to 40 parts water.

The moist weather being experienced is very conducive to the development of verrucosis, and a further spraying with Bordeaux mixture 3–4–50 should now be made; to this may be added nicotine sulphate 40 per cent. at a dilution of 1–800 if thrips are present. Unfruitful trees and trees of a poor type may be reworked by budding to a more suitable class of trees as soon as the necessary bud-wood can be obtained. All bud-wood should be obtained from shoots of selected trees which are of good habit and which produce the desired type of fruit.

Attention of growers is drawn to the provisions of the amended regulations relating to the sale, for consumption within the Dominion, of New-Zealand-grown fruit which have been recently gazetted and which contain grading standards for lemons.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Selecting Breeding Hens.

In view of the fact that the signs which go to indicate usefulness mostly disappear when the moulting process begins, and that just before that time certain signs, which indicate vigour, constitution, and production, manifest themselves in a marked way, no time should be lost now in selecting the breeding-hens for the coming season.

As the breeding-hen is the foundation of the poultry industry, and the poultry-keeper's future success depends very largely upon the class of bird he places in his breeding-pens, this work of selection is perhaps one of the most important and interesting jobs of the year. The art of breeding is the ability to select birds which, when mated, will produce offspring nearest to the standard or model aimed at. The successful breeder who year after year maintains, and even improves, the high quality of his stock knows what he is aiming at, as he has a definite model or standard to guide him, and has an affection for his birds, together with a great faith in the breed in which he is specializing. He is a real enthusiast and spends considerable time studying the various points of the individual birds, and finally he has that gift of weighing up at a glance the characteristics of a bird. Further, the successful selector and breeder of utility stock is not set back by a few disappointments. No doubt the art of selection is easier for some than for others, but when we think that the many breeds of poultry have been evolved from the jungle fowl it indicates that the art of selection can be cultivated. The three main points to keep in view when selecting utility breeding birds are—(1) purity of blood; (2) vigour and constitution; and (3) capacity to produce and reproduce.

Whatever breed the poultry-keeper takes up he should study the recognized standard for that particular breed, so that he becomes able to make the best possible selection of the birds at his command. For instance, to the uninterested person all Leghorns appear alike, but the more a person studies his breed, and the more natural aptitude he possesses, the more difference he will see in each individual.

A study of the standard is necessary in order to give a model to select by, for unless one has a definite model or object to aim at when selecting breeding-hens much permanent improvement can hardly be expected. Leghorn-breeders would do well to take as a model, when selecting breeders at this time of the year, bird No. 1, "a good breeding specimen," as shown on page 50 of this Department's Bulletin No. 66, "Utility-poultry Keeping."

Purity of blood is mentioned first, as experience has shown that mongrel birds are not profitable in comparison with a good strain of purebred utility birds.

As type and carriage are the chief characteristics of a purebred bird, these matters should receive consideration when selecting. Unfortunately, some utility-poultry keepers underestimate, or fail to appreciate, the value of these important items, with the result that one often sees many different types in a flock of the same breed and strain. The best breeders are known by the evenness of type in the birds they raise.

Though the object should be to breed birds as near to the standard as possible, it is well for the beginner to bear in mind that the finer arts of breeding cannot be mastered in a season or two. It is a good policy to start with a few birds of good type, and once that good type becomes well set in the flock the minor, or fancy points, can be given more consideration.

Vigour and Constitution.

Too much importance cannot be attached to constitution when it comes to selecting breeding stock, for the poultry-keeper who fails to realize the paramount importance of this characteristic, and endeavours to develop others, failing to watch closely vigour and constitution, sooner or later has to pay, perhaps heavily, for his neglect.

Naturally a good utility breeding-hen should be a good layer, but if hens that have laid well during the year show signs at the present time which indicate a lack of vigour or constitution, such as crooked breast-bones, weak flabby combs, or the laying of poor-shelled eggs, it is a mistake to use them for breeding-purposes. As mentioned in previous notes, the late moulters are usually amongst the strongest and best birds, and physical activity is perhaps the chief evidence of vigour and constitution, so poultry-keepers should look for the birds that are quick in movement, constantly on the hunt for food, and last to go to roost. If these birds are handled at night their crops are found to be large and full and their legs, which should be carried well apart, rather warm to the touch.

Slow-moving or sluggish birds are not, as a rule, very robust, and seldom possess that constitution necessary to lay eggs containing the fertility and vitality necessary to produce the best offspring. No doubt vigour and vitality may be improved by good management, but constitution can be depended upon only when it is inherited and bred into birds for generations. Years of experience have shown that when crooked breast-bones, weak flabby combs, or poor-shelled and small eggs start to show up in greater numbers it should be taken as a warning that the vigour and constitution of the flock are going back, and that more care is necessary in the selection of the breeding-stock, with perhaps the necessity of some fresh blood.

Capacity to Produce and Reproduce.

The only infallible way to ascertain the number and class of eggs each hen lays is by the use of the trap-nest, or single pen, and it is only by breeding from a bird and testing its offspring that one can ascertain the true value of a bird as a breeder. However desirable this practice may be, no

doubt owing to the want of suitable facilities and the cost of carrying out the work, very few utility-poultry keepers in this country adopt this system for selecting their breeding hens.

The usual practice is to select in the autumn, just before the majority of the birds start to moult. The most likely breeding specimens will be the late moulters, with heads fairly fine, showing strength and character, not coarse but rather wide at the top, and of fair length; comb of medium size and thickness, but not coarse or flabby; wattles of medium size, fine in texture, and carried close together; feathering hard, tight, and dense, and often of a worn thread-bare appearance, while many good Leghorns will have a more-or-less straw-like tinge in the feathers at this time of the year. Body will show length, depth, and width, with a good crop-capacity and depth of abdomen. The back will be rather flat with good width, carried well back to the tail. The texture of the abdomen should be fine, silky, and flexible to the touch (a most important point). Legs will be carried well back and wide apart. With regard to size, this is a point which should be carefully watched, for as a general rule the tendency for the average size of flock of birds, especially if bred for great egg-production, is to get smaller. In fact, the better layers the birds are the more danger of deterioration, thus the more care necessary when selecting. Good eighteen-months-old breeding Leghorn hens should weigh from 4 lb. to 4¾ lb., and two-and-a-half year-olds from 4½ lb. to 5½ lb. each.

Some poultry-keepers are inclined to go for quantity at the expense of quality, which is a great mistake. If 40 per cent. of breeders can be selected from a flock of eighteen-months-old birds it is doing very well.

Where trap-nests or single pens are not used it is advisable after the breeding-hens have been selected to examine them carefully and select a few of the very best specimens for mating with the best male in order to breed cockerels for the following season's use. If this is done one is sure that the stud cockerels are from the best birds, and the quality of the flock is more likely to be kept at a high standard. It is the desire of the Department to assist poultry-keepers in keeping up the quality of their stock, and if those requiring advice on the selection of their breeding birds make application to the Department it will endeavour to make arrangements for an officer to visit their farms.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Final Extracting.

Where extracting has been delayed for any reason it is advisable to use great caution in removing the honey. The combs should be removed as expeditiously as possible, and care should be exercised not to incite the bees to rob by keeping the hives open longer than it is necessary to remove the surplus. A hasty examination of the brood-chamber should be made in case it is found that the bees have not filled the combs in the lower story with honey. If empty or partly filled combs are found it is highly important that they be replaced with good combs of honey from the super. On no account should one attempt to extract any honey from the brood-chamber. Do not leave combs lying about or expose vessels that have contained honey. Unless caution is exercised in regard to these details, when the final extracting is being done the beekeeper is more than likely to cause the bees to start robbing in a wholesale manner.

Preparation for Winter.

The time is at hand when it is of paramount importance that proper preparation be made for winter. If the colonies are to winter in good order, so as to escape the abnormal winter losses which sometimes occur, then it

behoves the beekeeper to attend to the leading factors that produce successful wintering. The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's crop arrives.

There are many matters that call for attention in preparing the colonies for winter, and among the most important which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection. It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering the colony. As a result, unless large numbers of young bees are being raised to take the place of the old bees, the colonies will dwindle seriously in the spring or become a total loss in the winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimulate the colonies by autumn feeding.

Next in importance to having a strong cluster of young bees is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens. A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished. In all cases these queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen, and set to work to supersede her, but this work should be anticipated by the beekeeper. Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies come out in the spring with a prolific queen, and the loss attendant upon queenless hives is greatly diminished.

If the beekeeper studies his interests and the welfare of his bees he takes care that every colony goes into winter quarters with plenty of good stores. This is a most important factor in successful wintering, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely and build up early in the spring and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend upon locality, and care must be exercised, more particularly in the South, to provide sufficient so that winter feeding may not have to be resorted to. In the North winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. In no case should a colony be left with less than 30 lb. of sealed honey, and it is wise to increase this amount to 40 lb. Abundance of stores is essential if winter losses are to be eliminated altogether.

Another important factor in the safe wintering of bees is that of protection. This may be provided for bees by housing them in a good watertight hive and protecting them by good shelter hedges or fences. Great annual winter losses occur in this country through lack of attention to hives, more particularly to the roofs. Leaky roofs should not be tolerated under any circumstances. When the roofs leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. Where the bees are kept dry the amount of food consumed to keep up the heat of the cluster is small compared with the stores eaten by the bees where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cool winds militate against brood-rearing, while they also prevent the bees from taking a cleansing flight during the spring months.

Care of Comb-honey.

There are factors in the proper treatment and care of comb-honey which the producer is apt to overlook when putting his honey on the market. Usually the practice followed is to despatch the crop to market, where it is sold, to be afterwards graded and cleaned by buyers who are alive to the demands of the local market. These buyers obtain a better price by grading and cleaning the comb-honey, whereas the producer can, by employing proper methods, demand an increased price. Comb-honey should be fully capped before removal from the hive, and it should not be left until its white appearance is destroyed by travel-stain, this being caused by the constant traffic in the hive. When the sections are removed they should be stored in a warm, dry room, as low temperatures hasten granulation, and granulated comb-honey is not likely to meet with ready sale. Moreover, comb-honey stored in a cold damp place is apt to "weep" (or absorb moisture from the atmosphere), forming beads on the surface of the comb, and in the course of time becomes sour, thus destroying its marketable value. As opportunity allows the sections should be cleaned of all propolis and stain, and this is best done by scraping the sections with a knife, and the operation finally completed by sandpaper. Care must be exercised not to damage the cappings of the comb and thus destroy its attractiveness.

Before forwarding the honey to market it should be carefully graded, and finally packed in cartons for the market. By the use of cartons the sections are secured from dust and insects and present an attractive appearance when offered for sale, besides being far less liable to breakage. In order to ensure safe transit excellent shipping-cases, which can be purchased from the hive-dealers, should be used. These cases are fitted with corrugated-paper cushions, which materially reduce the breakage from rough handling. A feature of these section crates is a sliding-cover which enables the honey to be readily examined. The crates are appreciated by the retailers, and at the same time help to increase the average price to the producer.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetables.

THE full enjoyment and economical use of many vegetables depend not only on a wise selection of varieties and careful culture; sound consideration must be given to harvesting and storage if there is to be no loss in quantity and quality and the stocks are to be available over a maximum period. Under most conditions here such crops as celery, parsnips, salsify, artichokes, autumn-sown carrots, and beet may be left in the ground during winter, with quite satisfactory results, and lifted in dry weather as required until about the month of August, when growth is about to recommence. They must then be lifted and stored where the conditions are cold, well ventilated, and not too dry. Main-crop carrots maturing about the month of April split if left in the ground and become coarse and fibrous, as do main-crop beet maturing at that time. These should be lifted in fine weather as soon as they mature and given the storage conditions before mentioned.

A lean-to shed with a southerly aspect is often a suitable place, especially when shaded by plantation trees and having ample means for ventilation in the higher part of the roof. Such a place is also suitable for potatoes stored in bins, sacks, or boxes, if it is clean, well drained, and dark, but not so dry as to cause the tubers to shrink. Considerable losses from decay occur if the stocks are contaminated by the presence of decayed tubers or waste carried over from a previous season in the store or its vicinity. This can readily be avoided by the methodical disposal of decayed waste

at all times and a thorough annual clean-up of the store, which may very well include a careful spraying of the interior with a reliable fungicide. Losses from decay may also occur through infection caused by decayed tubers overlooked when bagging up in the field; or a good crop, to all appearances sound, may be placed in the store and in a month may be in a useless condition due to the attack of the potato-moth. This attack, which is most likely to occur in warm, dry localities and seasons, may be avoided by picking up and bagging the tubers the same day as they are dug and placing them in a clean store. In this way the night-flying, egg-laying moth is unable to deposit on the tubers those eggs which later hatch out into caterpillar larvæ which tunnel the flesh and make tubers an early prey to organisms of decay. Doubtful stocks should be picked over after a month or two in storage, and if the infection is fairly extensive they should be used up as soon as possible. Large quantities stacked in a compact manner heat and sprout, especially in warm districts and in a store where attention to ventilation is neglected. In such localities they may be stored satisfactorily in slatted bins to a depth not exceeding 3 ft. or 4 ft., but in colder districts 6 ft. may be a maximum depth, as long as good ventilation is provided, except when there is danger of injury through frost. Where stocks are large and storage accommodation limited, a quantity for late use may be satisfactorily held in a pit or clamp outside if the tubers are quite sound. For this purpose a well-drained, cool position should be chosen and the pit made not more than 5 ft. or 6 ft. wide and the tubers piled as high as possible. To prevent heating the pit should not be completely sealed for the first few weeks; during that period the soil casing over the straw or fern covering should only be carried up to within a foot of the ridge. If these conditions are observed and the potato crop is carefully dug in fine weather as soon as ripe, and allowed to harden off for a few hours before gathering, it will be used to best advantage.

The onion crop requires somewhat similar storage conditions, the chief difference being a drier atmosphere. The bulbs should be lifted as soon as ripe (this is of especial importance in districts inclined to be humid and warm), placed in windrows consisting of five or six rows of bulbs, until the tops wither completely. If wet weather is experienced the windrows are turned over by the use of a wooden rake. When thoroughly dry the bulbs are trimmed with shears and bagged or placed in slatted crates and stacked in an open shed for a few weeks to cure thoroughly before storage or shipping. When cured the bulbs are cleaned by taking away the dry outer scales, bulbs which have thick necks or which are damaged are removed, and the remainder are graded to size. They will then store satisfactorily if placed in a comparatively dry atmosphere that is cool, with an even temperature and given thorough ventilation at all times except in wet or humid weather. If in slatted boxes they are stacked, like fruit, with 1 in. space between tiers and rows to permit of circulation of the air; or they may be spread 6 in. or 8 in. deep on slatted shelves; or small quantities may be "strung" and hung in a dry airy place in the old-fashioned manner. This latter method is particularly suitable for shallots held over for planting another season. All bulbs of this class deteriorate very quickly in a close atmosphere.

Vegetable marrows are best used in a green state when of a suitable size, but pumpkins, and what are known in America as winter-squash—such as the Hubbard varieties—should not be harvested until thoroughly ripe, but before they have been frosted. They are cut with a portion of the stem attached and left in the field to mature before carting. They must be handled and carted with care, as it is easy to injure them seriously at this stage. When they are stored in a warm, dry, airy place for a few weeks their shells harden and they then can stand somewhat lower temperatures and rougher handling if that is necessary.

In the warmer districts, especially where there is also a heavy annual rainfall, the ordinary late potato crop is rather difficult, but the sweet

potato, or kumara, generally grows well. For this and other reasons it is increasing in popularity in such areas. While the crop is best left growing as late as possible, it must be lifted before there is any frost or the tubers immediately under the crown are liable to injury. If frost kills the vines the kumaras should be dug immediately, as decay sets in on the dead vines and may pass down to the tubers. Digging must be done with the greatest care, as the slightest damage at this stage prevents the tubers keeping and storage losses are due chiefly to faulty handling before curing. Curing, which occupies about a week, is usually done by gathering the tubers into heaps and covering them with sacks every night, to dry them thoroughly before storage in a warm, dry chamber that can be ventilated in warm weather. Small quantities may be kept successfully by storing in sand so long as it is perfectly dry.

In the southern States of America where sweet potatoes are grown on a commercial scale the tubers are stored in crates, stacked to allow ample ventilation and to enable the air to circulate through them, in chambers that are heated to a temperature of about 80° F. for the first fortnight or so of the storage-period. When the roots are well dried off the temperature is allowed to drop to 55° and is held there for the rest of the storage period, giving ventilation freely when the weather permits. In this way, together with fresh crops such as celery, savoys, cauliflower, leeks, &c., also dry beans, pickles, and chutneys, the garden makes valuable contributions to the larder during the winter as well as the summer months.

To provide young spring onions at that season, when salads are so much in demand, a sowing should be made during the month of March—towards the end in the warmer districts. For this purpose the Rocca or Tripoli types are most suitable owing to their mild flavour and tender flesh. In warm districts with a considerable annual rainfall the sowing should be extended to also provide young plants for setting out in early spring that ripen their bulbs about the month of January, which is more satisfactory under such conditions than sowing the main crops in early spring as is done in the dry districts. The land selected for the seed-bed should be well drained and thoroughly cleaned of weeds by shallow cultivation for some time before sowing.

Where the tomato crop is of considerable importance it sometimes is advisable to select the seed under local conditions, so that while the fruit is of a type suited to one's requirements the plants are thoroughly acclimatized. Time and careful consideration should be given to the selection of plants from which seed is to be taken ; they should be free from serious disease, of good constitution, and carrying crops that are as satisfactory as possible in regard to quantity and quality. Fruit that is likely to be coarse or small should be removed from the bunches and the remainder allowed to ripen naturally on the plants, which should be flagged to enable them to be readily recognized. When the tomatoes are ripe they should be cut open and the pulp dropped into a little water. The water containing this pulp should be placed in a warm place and as soon as it commences to ferment it should be poured into a gravy-strainer and washed well under a tap of running water until clean seed only remains. The clean seed should be placed in a position where it dries quickly and well stirred frequently to prevent seeds sticking together. If the seed is stored in tins, or other airtight containers, it is as well to redry it after a short period to make sure of its condition. It should then remain in good condition for five years at least. When conditions are favourable for a good seed-harvest a generous supply should be taken to provide against contingencies. Another method of saving tomato-seed is to scoop the seeds from the fruit and let it drop on to sand that is quite dry and has been passed through a fine sieve ; the mixture should be well rubbed through the hands for some time and then spread to dry. When it is dry it should be rubbed again and sieved to remove the sand.

The Homestead Garden.

Land that has been cultivated to a fine tilth and cleaned by occasional hoeing to destroy seedling weeds, with a view to sowing it down in lawn, should now have the surface grades carefully adjusted and the ground consolidated by rolling when the soil is in a dry state. A moderate dressing of chemical fertilizers raked in, before broadcasting the grass-seed during calm weather, is generally advisable. The most suitable fertilizers for the purpose depend on local conditions, but in the fertile alluvial loam where the Green-keeping Research Committee at Palmerston North is carrying out its experiments a mixture composed of equal quantities of sulphate of ammonia and superphosphate at a rate of 1 oz. to the square yard has given excellent results, and may be taken as a basis for modification, as may be necessary, under other conditions. Under the above-mentioned conditions, which are frequently rather dry during the summer, a seed-mixture composed of two parts Chewings fescue (*Festuca duriuscula* var. Chewings) and one part of brown-top (*Agrostis tenuis*) at the rate of 1 oz. of the mixture to the square yard has given very satisfactory results. Under less fertile conditions the quantity might well be increased, and where there is a marked difference in soil and climate it would often be best to sow a mixture supplied by a local reliable seedsman. It is generally satisfactory after sowing the seed evenly to merely rake it in carefully.

Established lawns may now be given any extra attention that is necessary, such as returfing worn places, loosening up hard places with a fork, thoroughly raking the whole area and applying a light dressing of chemical fertilizer or a light top-dressing of a mixture composed of fine soil and manures. Where the lawns have been in constant use for games this attention is urgently needed and should be commenced as soon as the playing-season is finished, so that the most may be made of the interval between seasons which is generally all too short for this purpose.

A sharp look-out should be kept for insect pests. This is the season when damage may be done to lawns by the common earth-worm when numerous, or the subterranean caterpillar (*Porina*), or grassgrub (*Odontria zealandica*). Damage is best avoided by giving the matter prompt attention so soon as the attack is perceived.

—W. C. Hyde, Horticulturist, Wellington.

REVIEW.

Profitable Poultry Keeping, by M. W. STEWART. 198 pp. Whitcombe and Tombs, Ltd.

THIS book, by an author well known to many poultry-keepers, is designed primarily to assist farmers to explore the possibilities of poultry-keeping as a side-line, and it is fitted to be of considerable service in doing this. The advice it contains is given in simple, direct language, and the policy it enunciates is in general accord with that which has been advanced by the Department of Agriculture for many years. The book is obviously based on practical experience. It gives strict attention to the economic side of poultry-keeping as a business, and should prove decidedly useful on farms on which the farmer or members of his family desire to undertake utility-poultry keeping as a side-line. The book rightly stresses that poultry-keeping as a side-line, to be successful, must be well done. To some extent the scope of the book is indicated by the titles to the sections. These include: Choice of stock, housing of poultry, breeding, hatching, chick rearing, growing stock, table poultry production, poultry feeding, culling, anatomy of a layer, poultry hygiene, notes on common ailments and diseases. The book contains a considerable number of well reproduced illustrations which usefully supplement the written matter.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TRANSPLANTING ORANGE-TREE.

P. D. L. H., Gisborne :—

Please inform me the correct time and method of transplanting an orange-tree The tree in question is about 8 ft. high, and the trunk is about 12 in. in circumference at ground-level, and is at present bearing nearly two dozen oranges.

The Horticulture Division :—

A suitable time to remove the orange-tree would be towards the end of September, before new growth commences, performing the operation when the land is sufficiently dry and the weather dull without wind. Remove the fruit as soon as possible, and prepare the tree by cutting out dead wood and conflicting branches and by thinning other branches where they are at all congested. Then cut a trench round the tree, 2 ft. to 3 ft. from the base, going down until most of the horizontal roots are severed, and then working under the tree to sever the perpendicular roots. When all is clear allow the tree to lean to one side and fill in a little soil; then pull it over in the opposite direction and fill in a similar amount. By repeating this operation the tree roots are brought to the surface and the tree may be rolled on to a sledge for conveyance to its new site. A hole of ample dimensions for replanting should be dug before the tree is moved, and a supply of wet sacks should be available for covering the roots during removal to prevent them drying out. Some good soil for filling in round the tree when replanting would be beneficial, and care should be taken to see that the tree does not suffer from want of water during the summer.

FREE-MARTINS.

J. B. V., Te Mata :—

Are there any free-martins in twin lambs? Please give reasons whether twin lambs of different sex will reproduce or not.

The Live-stock Division :—

There are no free-martins amongst twin lambs, or, if such occur, they have never been recorded. The free-martin in cattle is a term applied to an animal born twin to a bull calf having the external marks of a female but failing to develop the pelvic female generative organs which are necessary to reproduction. Such neuter cattle are often raised under the impression that they are heifers, and it is found at a later date that female characteristics are wanting. The cause of the condition traces back to early fœtal life. When a cow bears twins, separate fœtal membranes are usually formed with each twin. In the uterus the membranes come to lie in direct contact with each other and sometimes fuse together, thus forming a connection in the circulatory or blood systems of the two fœtuses. When this fusion takes place between fœtuses of opposite sexes, the testicular secretion from the male fœtus finds its way into the blood system of the female, inhibiting the development of the female genital organs and rendering the animal permanently sterile. The female lamb of a male and female twin will in sheep always be found to be a true female with definite female organs and capable of reproducing. Probably this is because the two ovaries in ewes tend to produce ova at the same time, and the ova when fertilized grow in different horns. Double ovulation or fission of one ova more frequently occurs in cattle.

Sir W. D. Hunt has been reappointed the representative of stock and station agents on the New Zealand Meat-producers Board.

WEATHER RECORDS: JANUARY, 1936.

Dominion Meteorological Office.

NOTES FOR JANUARY.

IN the North Island January was a very wet month. Most places in the Auckland and Hawke's Bay Provinces, indeed, had two to three times the average rainfall. In consequence, there has been unusual growth of grass, pastures are very green, and feed abundant. Stock generally are in very good condition and the milk-yield is high. The weather was, however, too wet for satisfactory haymaking, and much cut hay was lost. The pasture-growth is too abundant also for lambs to fatten very well. Fruit crops, especially stone fruit and tomatoes, suffered considerably from the excessive moisture.

In the South Island conditions were very different, rainfall being much below normal in most districts. On the other hand, there was very little westerly wind, and consequently an absence of dry and sunny weather. Feed generally is plentiful, though in some parts fresh green pasture is lacking. Again, though stock are mostly in good condition, lambs are not fattening as well as usual. Wheat crops promise to be heavy.

In the country as a whole the season is a backward one, fruit and crops maturing as much as three weeks later than usual.

Rainfall.—The great excess of rainfall in the North Island has already been mentioned. In the South Island there was an average deficit of about 50 per cent. In Nelson and Marlborough the falls approached the average, and Oamaru and Invercargill also had good rains. North Canterbury and the west coast had a particularly dry month.

Temperatures.—Though the departures were nowhere very large, temperatures were generally above normal, especially in the interior and on the west coast.

Sunshine.—Sunshine was considerably above normal in the interior of the South Island at Lake Tekapo and Alexandra, and on the west coast at New Plymouth and Hokitika, but in most other places was below it. Hawke's Bay and Canterbury had unusually low values.

Pressure and Storm Systems.—For the first five days of the month an anti-cyclone covered New Zealand, and the weather was fine. Between the 6th and the 8th, though pressure remained high to the east, a series of shallow depressions moved on to the Dominion. North-easterly gales and heavy rain occurred in the North, North Auckland experiencing some flooding. Good rains were recorded over most of the North Island, but in the South they were lighter.

Between the 11th and the 17th a somewhat similar series of depressions made their appearance. General rains were again recorded. A north-easterly gale was experienced in the Auckland Province on the night of the 14th to 15th, and floods occurred in North Auckland and the Bay of Plenty. On the 17th there were northerly or north-westerly gales at many places.

The third series of depressions, which were again only shallow, arrived on the 22nd to 23rd. Once more there was flooding in North Auckland, though elsewhere the rain was generally light. Finally, on the 29th to 30th, northerly gales occurred about and south of Cook Strait in connection with a westerly disturbance, though there was little rain. Thunderstorms were fairly frequent during the month.

RAINFALLS FOR JANUARY, 1936, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	12·08	14	2·59	3·94
Russell	24·01	10	8·00	3·25
Whangarei	9·45	13	2·42	3·93
Auckland	6·89	15	1·78	2·97
Hamilton	..	..	..	3·57
Rotorua	10·82	16	3·83	4·18
Kawhia	5·61	8	1·27	3·55
New Plymouth	8·44	9	2·42	4·18
Riversdale, Inglewood	12·36	13	4·01	7·51
Whangamomona	7·95	9	2·01	5·58
Hawera	3·57	10	1·13	3·51
Tairua	6·78	12	1·33	3·66
Tauranga	4·38	18	2·00	4·03
Maraehako Station, Opotiki	10·50	16	3·30	3·59
Gisborne	4·36	13	1·93	2·72
Taupo	8·07	18	2·00	3·37
Napier	5·13	10	2·10	2·50
Hastings	4·70	14	2·05	1·93
Whakarara Station	7·52	15	1·60	..
Taihape	4·65	10	2·57	3·16
Masterton	..	..	..	2·56
Patea	3·83	11	1·22	3·59
Wanganui	3·70	6	1·71	2·83
Foxton	3·73	8	1·18	2·14
Wellington	3·34	8	1·16	2·89
South Island.				
Westport	2·97	10	1·33	8·30
Greymouth	5·61	16	1·70	9·17
Hokitika	3·79	13	1·68	10·10
Ross	3·64	7	1·97	12·40
Arthur's Pass	3·11	4	2·30	14·12
Okuru, South Westland	7·52	6	3·20	12·59
Collingwood	10·77	9	6·22	6·71
Nelson	3·08	10	1·24	2·90
Spring Creek, Blenheim	1·92	8	0·64	2·22
Seddon	2·61	8	0·71	1·84
Hanmer Springs	1·51	11	0·58	3·95
Highfield, Waiau	0·84	10	0·21	2·98
Gore Bay	1·03	13	0·22	2·46
Christchurch	1·25	10	0·73	2·33
Timaru	1·55	11	0·38	2·39
Lambrook Station, Fairlie	1·17	6	0·33	2·43
Benmore Station, Clearburn	1·36	10	0·50	2·77
Oamaru	2·56	12	0·70	2·04
Queenstown	2·60	7	0·88	2·87
Clyde	0·88	6	0·29	1·85
Dunedin	1·56	12	0·58	3·41
Wendon	1·63	11	0·35	3·20
Balclutha	0·62	5	0·35	2·31
Invercargill	4·11	21	0·60	4·00
Puysegur Point	7·85	21	1·90	7·62
Half-moon Bay	3·16	14	0·61	4·83